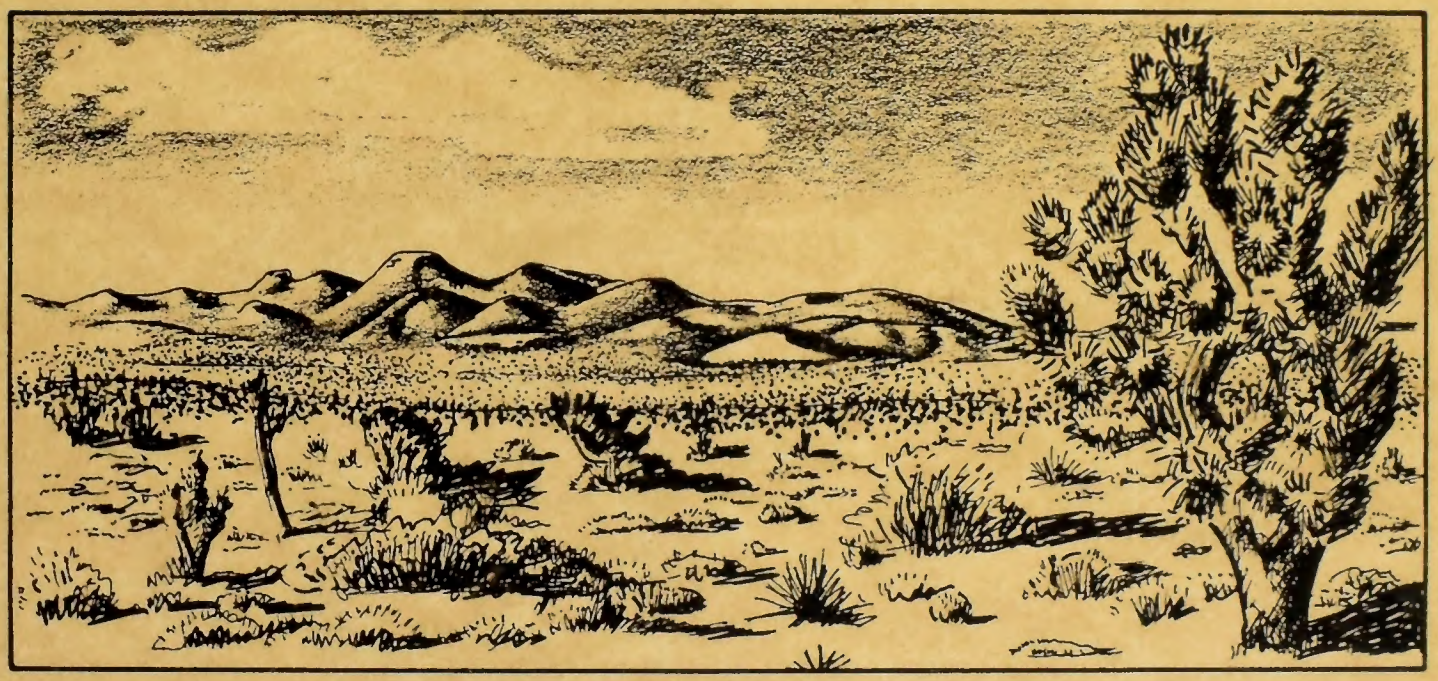
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VICEROY GOLD CORPORATION

CASTLE MOUNTAIN PROJECT

SAN BERNARDINO COUNTY, CALIFORNIA

MINE PLAN AND RECLAMATION PLAN



Prepared By:

Viceroy Gold Corporation
9457 Las Vegas Boulevard South, Suite B
Las Vegas, Nevada 89123
August, 1990

VICEROY

Prepared For:

County of San Bernardino
Environmental Public Works Agency
385 North Arrowhead Ave., 3rd Floor
San Bernardino, CA 92415-0182

United States Department of the Interior
Bureau of Land Management
Needles Resource Area
101 West Spike's Road
Needles, CA 92363

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TABLE OF CONTENTS

TABLE OF CONTENTS

	PAGE NO.
LIST OF TABLES	viii
LIST OF FIGURES	ix
S.0 SUMMARY	S-1
S.1 Introduction	S-1
S.2 Components of the Reclamation Plan	S-4
S.3 Operations	S-9
S.4 Bonding	S-10
1.0 RECLAMATION PLAN	1-1
1.1 Introduction	1-1
1.1.1 Preface	1-1
1.1.2 Purpose and Use of the Reclamation Plan	1-4
1.1.3 Statutory and Regulatory Requirements	1-5
1.1.3.1 Federal	1-6
1.1.3.2 State	1-7
1.1.3.3 County	1-9
1.1.4 Goals and Objectives of the Reclamation Plan	1-9
1.2 Post-Mining Land Use	1-10
1.2.1 Land Use	1-10
1.2.2 Post-Mining Land Use	1-17
1.3 Evaluation of Reclamation Success	1-19
1.3.1 Setting an Achievable Goal	1-19
1.3.2 Establishing a Timeframe for Reclamation Success	1-19
1.3.3 Establishing a Rationale for Evaluating Revegetation Success	1-20
1.3.4 Density and Diversity as Determining Factors for Reclamation Success	1-22
1.3.5 Performance Goals	1-24
1.4 Revegetation Research Program	1-24
1.4.1 Vegetation Inventory	1-27

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TABLE OF CONTENTS
(Continued)

1.5 General Criteria for Reclamation 1-27
- 1.5.1 Educational Program for Heavy Equipment Operators 1-28
- 1.5.2 Experimental Garden and Nursery 1-28
- 1.5.3 Salvage and Transplanting 1-28
- 1.5.4 Seedbank Establishment, Soil Salvage, and Handling 1-30
- 1.5.5 Land Shaping, Overburden Handling, and Placement 1-32
- 1.5.6 Soil Islands 1-32
- 1.5.7 Seedbed Preparation 1-33
- 1.5.8 Seeding and Planting Sources 1-34
- 1.5.9 Characteristics of Recommended Species 1-35
  - 1.5.9.1 Perennial Grasses 1-38
  - 1.5.9.2 Forbs 1-39
  - 1.5.9.3 Shrubs 1-40
- 1.5.10 Seeding and Planting Methods 1-41
- 1.5.11 Seeding and Planting Timeframe 1-42
- 1.5.12 Control of Weed and Exotic Species 1-42
- 1.5.13 Fertilization 1-43
- 1.5.14 Irrigation 1-44
- 1.5.15 Mulching 1-46

1.6 Reclamation Schedule 1-46
- 1.6.1 Stage 1 1-48
- 1.6.2 Stage 2 1-50
- 1.6.3 Stage 3 1-50
- 1.6.4 Stage 4 1-51
- 1.6.5 Stage 5 1-51
- 1.6.6 Stage 6 1-51
- 1.6.7 Stage 7 1-52
- 1.6.8 Stage 8 1-53
- 1.6.9 Stage 9 1-53
- 1.6.10 Stage 10 1-53
- 1.6.11 Temporary Suspension of Operations 1-54

TABLE OF CONTENTS
(Continued)

1.7 Maintenance and Management of Reclaimed Areas 1-55
1.7.1 Fencing and Protection from Herbivory 1-55
1.7.2 Monitoring and Maintenance 1-55
1.8 Decommissioning of Facilities 1-56
1.8.1 Mine Pits and Overburden Piles 1-56
1.8.2 Crushing Facilities and Conveying Systems 1-56
1.8.3 Solution Tanks, Basins, and Piping 1-57
1.8.4 Heap Leach Piles 1-57
1.8.5 Processing/Administration Structures 1-58
1.8.6 Other Facilities 1-58
1.8.7 Roads 1-59
1.9 Natural Revegetation and Existing Vegetation 1-59
1.9.1 Revegetation of Clay Quarries 1-59
1.9.2 Existing Vegetation 1-60
1.9.2.1 Regional Vegetation 1-72
1.9.2.2 Project Site Vegetation 1-74
1.9.2.3 Special Interest Species 1-74
1.10 Post-Mining Topography and Public Safety 1-82
1.10.1 Topography 1-82
1.10.2 Public Safety 1-86
1.11 Post-Mining Hydrology 1-86
1.11.1 Surface Water 1-86
1.11.1.1 Mine Pits, Overburden Pile, and South Clay Pit Reclamation Area 1-86
1.11.1.2 Crushing and Process Facilities, Heap Leach Pads, and Solution Tanks/Basins 1-88
1.11.1.3 Leachate from Ore, Protore, and Overburden 1-89
1.11.1.4 Access Road 1-89
1.11.2 Ground Water 1-90
1.11.3 Drainage, Erosion, and Sedimentation Control 1-91

TABLE OF CONTENTS
(Continued)

2.0 MINING PLAN 2-1

2.1 Introduction 2-1

2.2 Major Project Components 2-3

2.3 Production Schedule 2-7

2.4 Mining Plan 2-10

2.4.1 Growth Media 2-10

2.4.2 Mining 2-10

2.4.2.1 Pit Design 2-10

2.4.2.2 Operations 2-14

2.4.2.2.1 Pit Characteristics 2-14

2.4.2.2.2 Mining Equipment 2-18

2.4.2.2.3 Procedures 2-18

2.4.3 Staged Development 2-18

2.4.3.1 Stage 1 2-22

2.4.3.1.1 General Description 2-22

2.4.3.1.2 Lesley Ann Pit 2-24

2.4.3.1.3 South Clay Pit Reclamation Area 2-24

2.4.3.1.4 South Overburden Pile 2-26

2.4.3.1.5 Project Facilities 2-26

2.4.3.1.6 Heap Leach Pad Area 2-26

2.4.3.1.7 Onsite Roads 2-27

2.4.3.2 Stage 2 2-28

2.4.3.2.1 General Description 2-28

2.4.3.2.2 Lesley Ann Pit 2-28

2.4.3.2.3 South Clay Pit Reclamation Area 2-28

2.4.3.2.4 South Overburden Pile 2-28

2.4.3.2.5 Project Facilities 2-31

2.4.3.2.6 Heap Leach Pad Area 2-31

2.4.3.2.7 Onsite Roads 2-31

TABLE OF CONTENTS
(Continued)

2.4.3.3 Stage 3 2-31
2.4.3.3.1 General Description 2-31
2.4.3.3.2 Lesley Ann Pit 2-33
2.4.3.3.3 South Clay Pit Reclamation Area 2-33
2.4.3.3.4 South Overburden Pile 2-33
2.4.3.3.5 Project Facilities 2-33
2.4.3.3.6 Heap Leach Pad Area 2-34
2.4.3.3.7 Onsite Roads 2-34
2.4.3.4 Stage 4 2-34
2.4.3.4.1 General Description 2-34
2.4.3.4.2 Lesley Ann Pit 2-34
2.4.3.4.3 South Clay Pit Reclamation Area 2-34
2.4.3.4.4 South Overburden Pile 2-36
2.4.3.4.5 Project Facilities 2-36
2.4.3.4.6 Heap Leach Pad Area 2-36
2.4.3.4.7 Onsite Roads 2-36
2.4.3.5 Stage 5 Through Stage 9 2-36
2.4.3.5.1 General Description 2-36
2.4.3.5.2 Open Pit Mining Activities 2-37
2.4.3.5.3 South Clay Pit Reclamation Area 2-39
2.4.3.5.4 South Overburden Pile 2-39
2.4.3.5.5 Project Facilities 2-39
2.4.3.5.6 Heap Leach Pad Area 2-40
2.4.3.5.7 Onsite Roads 2-40
2.4.3.6 Stage 10 2-41
2.4.4 Mine Product Characterization 2-41
2.5 Ore Processing 2-44
2.5.1 Crushing and Conveying Circuit 2-44
2.5.2 Heap Leach System 2-44
2.5.3 Gold Recovery 2-44
2.6 Water Impoundments and Diversions 2-48

TABLE OF CONTENTS
(Continued)

2.7 Utilities and Supplies 2-50
2.7.1 Water Requirements and Supply 2-50
2.7.2 Other Utilities and Structures 2-53
2.7.3 Supplies 2-54
2.7.4 Waste Containment, Treatment, and Disposal 2-54

3.0 RECLAMATION ASSURANCE 3-1
3.1 Introduction 3-1
3.2 Bond Requirements 3-2
3.3 BLM/County Bond and Adjustments 3-6

4.0 SUPPLEMENTAL INFORMATION 4-1
4.1 Introduction 4-1
4.2 Brief History of the Hart Mining District 4-1
4.2.1 Onsite Mining Phases 4-9
4.2.1.1 8000 B.C. - 1900 A.D. 4-9
4.2.1.2 1908 - 1911 4-9
4.2.1.3 1930 - 1942 4-9
4.2.1.4 1920 - Present 4-10
4.2.1.5 1985 - 2000 4-10
4.3 Visual Resources 4-10
4.3.1 Visual Management 4-10
4.3.2 Regional Characteristics 4-11
4.3.3 Project Site Characteristics 4-12
4.3.4 Visual Description of the Area 4-12
4.3.4.1 Castle Mountain Project 4-13
4.3.4.2 Photograph Simulations 4-15
4.3.4.3 Topographic Model 4-24
4.3.4.4 Visual Impacts After Reclamation 4-24
4.3.4.5 Conclusion 4-29

TABLE OF CONTENTS
(Continued)

4.4	Geologic Setting	4-29
	4.4.1 Physiography	4-29
	4.4.2 Geology	4-30
	4.4.3 Ore Deposits	4-30
	4.4.4 Soils Inventory	4-34
4.5	Water Resources	4-39
	4.5.1 Surface Water	4-39
	4.5.2 Ground Water	4-43
	4.5.2.1 Lanfair Valley Conditions	4-43
	4.5.2.2 Water Quality	4-47
4.6	Wildlife	4-54
4.7	Air Resources	4-56
	4.7.1 Climate	4-56
	4.7.2 Air Quality	4-56
4.8	Cultural Resources	4-56

APPENDIX A: RECLAMATION MITIGATION MEASURES
APPENDIX B: BLM/STATE OF CALIFORNIA MEMORANDUM OF UNDERSTANDING
APPENDIX C: GUIDELINES FOR THE DEVELOPMENT OF A REVEGETATION PLAN
APPENDIX D: CLOSURE AND POST-CLOSURE PLAN
APPENDIX E: LIST OF PERMITS AND APPROVALS
APPENDIX F: SOIL SURVEY FOR THE CASTLE MOUNTAIN PROJECT
APPENDIX G: LIST OF WILDLIFE
APPENDIX H: CULTURAL RESOURCE CONSULTATION
APPENDIX I: REFERENCES AND RESOURCES

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

TABLE NO.	TITLE	PAGE NO.
S.1	Summary of Reclamation Activities	S-5
1.1	Timeframe Established for Reclamation Success	1-21
1.2	Seed List, Planting Methods and Uses	1-36
1.3	Seeding Rate Information	1-37
1.4	Reclamation Stages and Chronological Relationships	1-47
1.5	Incremental Acreage Prepared for Revegetation By Stage	1-49
1.6	Natural Recovery of Perennial Plant Species on Clay Quarry Overburden Piles	1-65
1.7	List of Plants in the Castle Mountain Area	1-66
1.8	Special Interest Plants in the Vicinity of the Castle Mountain Project Site	1-66
2.1	Estimated Annual Production	2-8
2.2	Estimated Pit Characteristics	2-11
2.3	Estimated Pit Dimensions by Stage	2-12
2.4	Major Mine Operations Equipment	2-19
2.5	Production Stages and Chronological Relationships	2-20
2.6	Incremental Acreage Disturbed by Stage	2-21
2.7	Stage 1 - Onsite Road Lengths	2-29
2.8	Onsite Road Lengths	2-42
2.9	Summary of Results, Analysis of Ore, Protore, and Overburden	2-43
3.1	Reclamation Costs - Stage 1	3-4
4.1	Project Access Route	4-6
4.2	Unsuitability Criteria for Soil or Soil Substitutes	4-38
4.3	Ground Water Analysis, Well 18-P	4-53

TABLE OF CONTENTS
(Continued)

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE NO.
1.1	Lanfair Valley Recreational, Environmental, and Wilderness Management Features	1-13
1.2	Aerial Photograph of Castle Mountains	1-15
1.3	Natural Revegetation of North Clay Pit Overburden	1-61
1.4	Natural Revegetation of South Clay Pit Overburden	1-63
1.5	Plant Communities	1-75
1.6	Stephens' Beardtongue Location	1-77
1.7	Post-Mining Topography and Cross Sections	1-83
1.8	In-Pit Catchment Area, Infiltration Basins and Diversion Ditch	1-87
2.1	Generalized Heap Leach Mining Operation	2-2
2.2	Preliminary Site Plan	2-5
2.3	Current Lesley Ann Pit Design	2-15
2.4	Cross-Sections Through the Current Lesley Ann Pit Design	2-16
2.5	Current Oro Belle Pit Design and Associated Cross Section	2-17
2.6	Project Status at the End of Stage 1	2-23
2.7	Location of Pacific Clay and Oro Belle Patented Claims	2-25
2.8	Project Status at the End of Stage 2	2-30
2.9	Project Status at the End of Stage 3	2-32
2.10	Project Status at the End of Stage 4	2-35
2.11	Preliminary Project Status at the End of Stage 9	2-38
2.12	Mining and Crushing Operations Diagram	2-45
2.13	Heap Leach Process Diagram	2-46
2.14	Generalized Gold Recovery Plant Process Diagram	2-47
2.15	Watersheds Affected by the Lesley Ann and Oro Belle Pits	2-49
2.16	Preliminary Utilities Plan	2-51

TABLE OF CONTENTS
(Continued)

LIST OF FIGURES
(Continued)

FIGURE NO.	TITLE	PAGE NO.
4.1	Regional Location Map	4-2
4.2	Vicinity Map	4-3
4.3	Project Site	4-4
4.4	Project Access Route Map	4-5
4.5	Visual Analysis Viewpoints	4-16
4.6	Viewpoint No. 1 (Lanfair Road)	4-17
4.7	Viewpoint No. 2 (Railroad Grade Road)	4-19
4.8	Viewpoint No. 3 (East Mojave Heritage Trail)	4-21
4.9	New York Mountains Viewpoint	4-25
4.10	Examples of Rock Staining	4-27
4.11	Site Area Geology and Cross Section A-A'	4-31
4.12	Soil Mapping Units and Test Pit Locations	4-35
4.13	Lanfair Valley Surface Water Drainage	4-41
4.14	Project Site Surface Water Drainage	4-44
4.15	Location of Well and Spring Data Points	4-45
4.16	Lanfair Valley Hydrogeologic Cross Section	4-49
4.17	Estimated Potentiometric Surface Map	4-51

SUMMARY

SUMMARY

S.1 INTRODUCTION

1. Reclamation will be an integral part of Viceroy Gold Corporation's (Viceroy) entire mining process for the Castle Mountain Project. In California, the Surface Mining and Reclamation Act (SMARA) requires preparation and approval of a reclamation plan as part of the overall permitting process for an open pit mine. Under the Federal Land Policy Management Act (FLPMA), reclamation of disturbances is a vital component in preventing unnecessary or undue degradation. The reclamation program for this project will be implemented after consultation with, and approval by, the Bureau of Land Management (BLM) and the County of San Bernardino (County). A bond will be posted to ensure that adequate financial resources are available to implement this program. Reclamation at the Castle Mountain Project will be conducted concurrently with mining activity, and therefore, revegetation will be of higher quality, more quickly achieved, and less expensive than if revegetation were to be strictly a post-mining effort.

2. Present uses of the site include recreation, grazing, wildlife habitat, and mining. Post-mining land uses of the site will remain the same, based on their compatibility with adjacent land uses, zoning restrictions, County general plans, post-mining topography, and impact mitigation.

3. The goals of reclamation are to ensure the site is left in a condition that does not present a threat to public safety and health, that air and water quality are protected, and that reasonable measures are taken to promote revegetation and a productive second use of the site. Viceroy's reclamation plan is designed to:

   - Provide a diversity of habitat for post-mine land use.
   - Provide an aesthetically-pleasing landscape that blends into the natural landscape of the area.
   - Stabilize the soil surface to prevent wind and/or water erosion.
   - Provide diversified flora that will eventually mirror the existing major plant communities.
   - Establish desirable native perennial plants to discourage occupation of the site by populations of weeds.
   - Establish a stable, self-perpetuating community that will maintain itself without further cultural inputs.

4. Operations at the project site will cumulatively affect up to 890 acres of vegetation, which is less than 0.4 percent of the vegetation in Lanfair Valley. The unreclaimed area at any one time will be less than this, since revegetation efforts, including the establishment of a nursery onsite and the transplanting of salvaged plant species, will occur concurrently with mining operations, thereby accelerating natural revegetation processes. Disturbances from the project access route will represent an additional 25 acres.

5. Development of the Castle Mountain Project has been separated into ten distinct stages. These stages are separated based on the interrelationships between preproduction development and plant construction; mining; placement of ore, low grade ore, protore, and overburden; and reclamation efforts.

6. Reclamation activities will occur in the areas described below:

   - **Clay Pits** - Big Chief Hill is a landmark visible from much of northern Lanfair Valley, owing to the presence of a clay quarry 200 feet high, 500 feet wide, and 1,200 feet long, on the flank of the hill. A second, somewhat smaller clay quarry about three quarters of a mile to the north, overlooks the abandoned townsite of Hart. Due to the white color and reflective nature of the clay minerals, the quarries are in stark contrast to their surroundings.

     Since these quarries are exposed to full view from the main road in Lanfair Valley, their reclamation as a voluntary effort by Viceroy as part of its overall reclamation program will result in a substantial improvement in the visual quality of the area.

     Approximately 4.5 to 5 million tons of overburden will be used to backfill the South Clay Pit Reclamation Area to form four terraces. These terraces have been designed to bury the light colored rock surfaces exposed by previous clay quarrying activities. Growth media will be placed and the area will be seeded with native vegetation. Salvaged plants will be transplanted.

   - **Overburden Pile** - Overburden placed in the South Overburden Pile will ultimately cover an area of about 300 acres, and reach a maximum height of 200 feet along a portion of its south face. Development of this overburden pile will initially take place on a single lift, to create a reasonably level surface for the placement of stockpiles of mineralized material. After sufficient room has been established for these stockpiles, the south face of the overburden pile will be advanced by placing overburden material in two lifts along the southern perimeter of the pile. These lifts will produce an overall final slope of 2H:1V (horizontal to vertical). At completion, the south face will have a shallow scalloped shape, to more closely replicate the shape and appearance of other hillsides in the area of the project.

The South Overburden Pile will be rounded to conform with existing topography. Infiltration basins will allow surface water to percolate through the overburden pile. Growth media will be placed and the area will be seeded with native vegetation. Salvaged plants will be transplanted.

- **Mine Pits** - The roads and floors of the pits will be ripped and scarified, growth media will be placed, and the area will be seeded with native species. Salvaged plants will be transplanted. Clay material remaining from old clay mine workings will be placed on the bottom of the Lesley Ann Pit to create an ephemeral pond for wildlife and migrating birds.

  Benches will be left on the high walls as a safety measure, to retain material that may work free from the walls. The walls will be "scaled" to remove loose rock, minimizing this problem. The benches will serve as niches for the establishment of vegetation through seeding, in addition to providing nesting areas for birds.

  Since the proposed pits are flanked by hills, the size of the pits will not be apparent to passers-by, as only the upper benches of the pit walls will be visible. These sections of the pit walls will be treated with Permeon rock-staining solution to reduce visual contrast with adjacent, undisturbed slopes.

- **Heap Leach Pile** - Heap leach material will ultimately cover an area of about 330 acres, and will be approximately 80 feet in height. The heap leach piles will have as many as four 20 foot lifts with appropriate setbacks on benches between lifts to produce an overall 2H:1V (horizonal:vertical) slope face. After spent heap leach piles have been detoxified, the sides will be flattened to produce an overall 2.5H:1V slope. The heap leach pads will be rounded to conform with existing topography. Microcatchment basins will enhance the likelihood of species diversity onsite. Growth media will be placed and the seedbed prepared. The area will be seeded with native vegetation. Salvaged plants will be transplanted.

- **Facilities** - Buildings and structures not needed for continued reclamation will be dismantled and removed. The Crusher, Process Plant, Solution Storage, and Administration areas will be reclaimed by removing the structures and foundations, ripping and scarifying underlying ground, placing growth media, preparing the seedbed, seeding the areas, and transplanting salvaged plants.

- **Roads** - All roads designated by BLM for closure will be ripped and scarified. Growth media stockpiled in berms adjacent to the roads will be replaced. Sidehill roadcuts will be reclaimed by replacing material from the downslope side of the hill with a backhoe. Seedbeds will be prepared for revegetation, and the area will be seeded with native vegetation. Salvaged plants will be transplanted.

- **Soil Storage Areas** - Areas disturbed from the storage of seedbank and growth media material will be scarified. Seedbeds will be prepared and the areas will be seeded with native vegetation. Salvaged plants will be transplanted.

Acreages associated with the disturbance and reclamation of the foregoing locations are summarized in Table S.1, Summary of Reclamation Activities.

S.2 COMPONENTS OF THE RECLAMATION PLAN

1. The key components of Viceroy's Reclamation Plan are explained in the sections that follow.

- **Educational Program For Heavy Equipment Operators** - Employees operating heavy equipment for the purpose of reclaiming the project site will be required to attend an educational session(s) on land shaping, vegetation and soil salvage, seedbank preparation, soil stockpile preparation, contouring, placement of soil and seedbank material, the value of an undulating topography, and seeding. The purpose of the session(s) is to educate heavy equipment operators about state-of-the-art reclamation techniques.

- **Experimental Garden and Nursery** - The Castle Mountain Project will establish an experimental garden and nursery for the purpose of evaluating establishment and persistence of seed and nursery stock from commercial sources and those collected onsite.

  Young to medium sized shrubs will be salvaged and transplanted in the nursery for future revegetation activities. This will be a recurring activity throughout the life of the mine.

- **Seedbank Establishment, Soil Salvage and Handling** - Seedbank material from the Administration Area will be salvaged for trials to be conducted in the research program. Growth media will be removed and stockpiled, so that it can be spread back on the site after it is prepared for revegetation.

- **Native Sources of Plant Materials** - A native seed mixture will be used at the Castle Mountain Project, subject to approval by the BLM and County. Seed will be collected onsite and will also be obtained from local seed distributors. Certification programs will verify that distributors maintain the genetic integrity of released varieties. Varieties will be selected for good performance on different types of sites.

  A goal of the reclamation plan is to transplant at least 25 percent of the barrel cactus and 25 percent of the Joshua trees. Mojave yucca, buckhorn cholla, beavertail cactus, prickly pear cactus, and other plants will be evaluated in the Reclamation Research Program, for survivability after transplanting.

  Wildings will be transplanted from areas that will be disturbed. The use of wildings will increase species diversity onsite.

- **Land Shaping** - Landforms will be rounded and contoured to provide an aesthetically pleasing landscape that blends into the natural landscape of the area. Landforms will have a naturally appearing configuration.

- **Proper Overburden Handling and Placement** - Final overburden handling has a direct and substantial effect on reclamation success. Special handling techniques will create subsurface features designed to improve reclamation success while conforming with the natural landscape.

TABLE S.1

SUMMARY OF RECLAMATION ACTIVITIES

LOCATION OF DISTURBANCE OR RECLAMATION	DISTURBANCES			PREPARED FOR RECLAMATION			COMPONENTS OF RECLAMATION	POST-MINING LAND USE	TEXT REFERENCE
	ACRES	STAGE	MONTHS	ACRES	STAGE	MONTHS			
Lesley Ann Pit	71 19 10	1 3 6	0-7 19-31	 10	 6		• Rip pit and haul road floors. • Place growth media on floors in soil islands. • Prepare seedbed. • Seed floor, roads, and berms. • Place clay on floor of pit area to create ephemeral pond. • Transplant salvaged species. • Stain specified visible sections of upper pit walls.	Mining, livestock grazing, recreation, and wildlife habitat	S.3 1.5 1.6.1 1.6.2 1.6.3 1.6.4 1.6.5 1.6.6 1.6.10 1.7.2 1.10.1 3.2
Subtotal	100			10					
Oro Belle Pit	35	5		6	7		• Rip pit and haul road floors. • Place growth media on floors in soil islands. • Prepare seedbed. • Seed floor, roads, and berms. • Transplant salvaged species.	Same as above	S.3 1.5 1.6.4 1.6.5 1.6.7 1.7.2 1.10.1 3.2
South Clay Pit Reclamation Area				6 6 20 4	2 3 4 7	7-19 19-31 31-43	• Place overburden against existing clay pit walls. • Make microcatchment basins. • Place "soil islands." • Prepare seedbed. • Seed area. • Transplant salvaged species.	Same as above	S.2 1.5 1.6.2 1.6.3 1.6.4 1.6.7 1.8.1 1.9.1 1.10.1
Subtotal				36					3.2 4.2
South Overburden Pile	77 77 40 15 30 30 31	1 2 3 4 5 6 7	0-7 7-19 19-31 31-43	 5 25 30 30 30 30 100 50	 2 3 4 5 6 7 8 9	7-19 19-31 31-43	• Scallop face of overburden pile. • Overall 2H:1V final slope. • Place "soil islands." • Place infiltration basins. • Prepare seedbed. • Seed area. • Transplant salvaged species.	Same as above	S.2 1.5 1.6.2 1.6.3 1.6.4 1.6.6 1.6.7 1.6.8 1.7.2 1.9.1
Subtotal	300			300					1.10.1 3.2

TABLE S.1

SUMMARY OF RECLAMATION ACTIVITIES
(Continued)

LOCATION OF DISTURBANCE OR RECLAMATION	DISTURBANCES			PREPARED FOR RECLAMATION			COMPONENTS OF RECLAMATION	POST-MINING LAND USE	TEXT REFERENCE
	ACRES	STAGE	MONTHS	ACRES	STAGE	MONTHS			
Heap Leach Pads	44 18 26 53 63 63 63	1 2 3 4 5 6 7	0-7 7-19 19-31 31-43	 100 100 130	 6 7 9		• Detoxify heap leach piles. • Average 2.5H:1V final slope. • Make microcatchment basins. • Prepare seedbed. • Seed area. • Transplant salvaged species.	Same as above	S.1 1.5 1.5.14 1.6 1.6.5 1.6.6 1.6.7 1.6.9 1.6.11 1.8.4 1.10.1 3.2
Subtotal	330			330					
Solution Storage Tanks and Basins	5 5	1 6	0-7	 10	 9		• Remove accumulated sludge. • Bury concrete and liner in basin. • Rip and scarify. • Replace to approximate pre-mining contour. • Place soil islands. • Prepare seedbed. • Seed area. • Transplant salvaged species.	Same as above	S.3 1.5 1.6.10 1.8.3 3.2
Subtotal	10			10					
Crusher Area	10	1	0-7	10	8		• Remove structures and foundations. • Rip and scarify. • Place soil islands. • Prepare seedbed. • Seed area. • Transplant salvaged species.	Same as above	S.3 1.5 1.6.4 1.6.7 1.6.8 1.8.2 3.2
Process Plant	4	1	0-7	4	9		• Remove structures and foundations. • Rip and scarify. • Place soil islands. • Prepare seedbed. • Seed area. • Transplant salvaged species.	Same as above	S.3 1.5 1.6.10 1.8.5 3.2

TABLE S.1

SUMMARY OF RECLAMATION ACTIVITIES
(Continued)

LOCATION OF DISTURBANCE OR RECLAMATION	DISTURBANCES			PREPARED FOR RECLAMATION			COMPONENTS OF RECLAMATION	POST-MINING LAND USE	TEXT REFERENCE
	ACRES	STAGE	MONTHS	ACRES	STAGE	MONTHS			
Administration	1	1	0-7	1	9		• Remove structures and foundations. • Rip and scarify. • Place soil islands. • Prepare seedbed. • Seed area. • Transplant salvaged species.	Same as above	S.3 1.5 1.6.10 1.8.6 3.2
Roads	17 8 5	1 5 6	0-7	30	9		• If designated by BLM for closure: - Rip and scarify. - Replace bermed growth media-material. - Prepare seedbed. - Seed area. - Transplant salvaged species scarify and revegetate. - Road A68p will be reclaimed for horse riding.	Same as above	S.3 1.5 1.6.6 1.6.7 1.8.7 1.9.1 3.2
Subtotal	30			30					
Soil Storage	15 5 7 10 11 11 11	1 2 3 4 5 6 7	0-7 7-19 19-31 31-43	15 15 10 30	6 7 8 9		• Scarify. • Prepare seedbed. • Seed area. • Transplant salvaged species.	Same as above	S.3 1.5 1.6.6 1.6.7 1.6.9 1.8.7 3.2
Subtotal	70			70					
TOTAL	890			870					

88-148B (8/21/90)

NOTES:

Stage 1 starts after receipt of the BLM's Record of Decision respecting the Plan of Operations for the Castle Mountain Project and the County's approval of the Mine/Reclamation Plan Application.

Stage 10 involves revegetation activities in areas from which buildings and equipment have been dismantled and removed following project decommissioning (see Section 1.8, Decommissioning of Facilities). Stage 10 will commence within six months after project decommissioning and will end after the fifth growing season following the initial plantings on the locations involved in project decommissioning.

Months past Stage 5 are not shown due to the variability in factors affecting the calculated timeframe. Each stage is approximately 12 months.

Overburden material will be placed to develop an undulating topography, thereby maximizing diversity through ecotypes. The final overburden pile surface will be scarified or otherwise treated to eliminate smooth surfaces between the overburden material and the growth media, and to allow roots to penetrate into overburden material. The treatment will be completed before spreading the growth media.

- **Revegetation Research Program** - A Revegetation Research Program will be conducted by the Desert Studies Consortium of the California State University system. This program will provide valuable research information. Very little reclamation research has been conducted on developing effective revegetation methods for the semi-arid desert. Documentation of both successes and failures will be made available to government agencies and the general public. Research will be conducted in the following areas:
  - **Seed Availability** - Local seed sources are desirable since ecotypic variation (local genetic variability) may be high. A seed collection plan for the site will be developed after review of the literature of data on the timing of seed development and maturity for the key species listed in the revegetation plan.
  - **Trials for the Establishment and Persistence of Seed and Nursery Stock** - An experimental garden and nursery will be established to evaluate the establishment and persistence of seed and nursery stock. Cuttings will also be evaluated for use onsite. A seed collection plan will be developed.
  - **Trials on Nursery Equipment and Inoculations** - Information will be established on the selection of containers for good root system development, potting media, inoculation recommendations for mycorrhizal fungi, and fertility management for the production of plants with high root/shoot mass ratio.
  - **Transplanting Procedures** - The experimental garden and nursery will primarily be used for transplanted stock. Different species will be evaluated based on their ability to survive transplanting and their long range viability. The effects of slope, angle, and elevation will be evaluated.
  - **Hardening Protocol for Nursery Grown Stock** - Nursery grown stock will be stressed prior to its establishment onsite. A hardening protocol will be established to wean plants from irrigation, shade, fertilization, and other cultural inputs.
  - **Field Trials on the Successful Establishment of Wildings** - The survivability of transplanted wildings (native plants from areas to be disturbed within the project site boundary) will be documented.
  - **Laboratory Experiments on Viability and Germination of Seed Bank Material** - The germination and viability of seed stockpiled in seed banks over time and at varying depths will provide valuable information about seed banking in the North American desert environment.
  - **Field Trials Using Fertilizers** - Fertilizers and soil amendments will be applied to test plots at rates which will be established through soil testing. Application rates and the frequency of application will vary on different test plots.

- **Mulch Field Trials** - Mulches will be evaluated for limited use onsite. Research will focus on the use of rock mulches and mulches made from unsalvageable material, in order to avoid the introduction of exotics.
- **Irrigation Field Trials** - Supplemental irrigation will be used where practical and feasible onsite. Test plots will be established to determine rate, frequency, and types of irrigation.
- **Herbivory** - Protective materials including cages will be placed over species that evidence a high degree of herbivory. The effectiveness of these protective devices will be evaluated.
- **Heap Leach Substrates** - Test plots will be established to determine the type of substrate necessary for plant growth on heap leach piles.

- **Performance Goals** - Success of the revegetation will be determined by measuring two parameters, density and diversity of perennial species. The parameters will govern bond release based on a percentage of recovery, and they will be compared to representative control sites that are relatively undisturbed. The 10-year goal for density, using only perennial species, will be 21 percent of the control. Using a sigmoidal curve, the 5-year goal will be six percent of the control. The 10-year goal for diversity will be 15 percent expressed as a similarity index of the control. The 5-year goal for diversity, based on a sigmoidal curve will be four percent, expressed as a similarity index of the control. The diversity and density measurements will be based on randomly allocated plots located within areas representative of the reclaimed lands. (A similarity index measures the similarity between two stands of vegetation, providing information about the number of species common to both, relative to the total number of species occurring in one stand or the other).
- **Monitoring and Maintenance** - Reclamation progress will be monitored by the BLM, State, and County. A monitoring and maintenance program will ensure that appropriate procedures are implemented to protect the environment and reclaim areas disturbed by operations. Vegetation inventories will be performed on undisturbed and reclaimed areas through the life of the mine and for five years beyond. Revegetation success will be monitored accordingly. Viceroy's onsite environmental coordinator will supervise the monitoring program and ensure that operations are undertaken in compliance with Federal, State, and County permits.
- **Reporting Requirements** - An annual report will be prepared each year to document both the successes and failures arising from the Revegetation Research Program and the nature and extent of reclamation activities at the project during the preceding year. The report will become part of the public record on file with the BLM and County.

S.3 OPERATIONS

1. The Castle Mountain Project as presently conceived will consist of two mine pits, known as the Lesley Ann and Oro Belle. Each pit will be developed using conventional open pit mining

methods. Mining will be done by a contractor. Viceroy personnel will carry out engineering and pit design requirements. Overburden placement will be to the south of the pits. Ore will be crushed to -3/8 inch at a rate of 8,000 tons per day. The crushed ore will be sent to an agglomerating plant for mixing with lime and/or cement. Agglomerated material will be sent to the heap for leaching, which will use a drip irrigation process. Gold recovery will use carbon columns and electrowinning, with onsite smelting to produce a doré bullion. The operation will use procedures that are standard in the industry with three stages of crushing, owing to the recovery characteristics of the ore.

2. In competent and stable rock, the bench configuration of the Lesley Ann Pit design will consist of a series of three 20-foot high benches with an approximate individual bench face angle of 63 degrees. A safety bench will be left at the base of each 60-foot pit wall segment. The width of this bench will be variable, based on a geotechnical assessment of the rock strength and stability. The overall slope angle will not exceed 60 degrees in competent rock. A similar configuration will be developed in poorly consolidated or clay altered zones, except the safety bench will be wider, resulting in an overall slope angle of 40 degrees.

3. The Oro Belle deposit has not been refined to the same degree as the Lesley Ann Pit design, since it will be mined after the Lesley Ann Pit. Reserves for the Lesley Ann and Oro Belle deposits have been classified as proven and probable, respectively.

S.4 BONDING

1. Viceroy will post a $619,000 bond to ensure that the financial resources needed to meet reclamation commitments in the Reclamation Plan will be available. A joint BLM/County bond will be administered by the County on behalf of itself and the BLM. Bonding requirements will be established at Year 0, and will be adjusted at Year 1 and at 2-year intervals thereafter, to reflect acreages that will be disturbed or which have been reclaimed. A detailed list of reclamation costs to cover surface disturbances undertaken during Stage 1 is shown in Table 3.1.

2. A separate bond totalling $398,898 will be posted with the Regional Water Quality Control Board (RWQCB) for operating and decommissioning activities involving heap leach pads, solution storage facilities, the process area and the overburden pile. There will be no duplication of coverage between the RWQCB bond, the BLM/County bond and any other bonds required for the Castle Mountain Project.

CHAPTER 1.0
RECLAMATION PLAN

1.0 RECLAMATION PLAN

1.1 INTRODUCTION

1.1.1 PREFACE

1. This Reclamation Plan (Plan) has been prepared to incorporate Federal, State, and County requirements. The Plan is based on information initially prepared for a Plan of Operations, submitted to the Needles Resource Area office of the BLM (Viceroy, 1988a) and the Application for Mining Reclamation Plan Review and Site Approval, submitted to the County Land Management Department (Viceroy, 1988b). In addition, this Plan incorporates recommendations received as a result of the environmental review process, as documented in the Castle Mountain Project Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) (Environmental Solutions, Inc., 1989), Supplement to the Draft EIS/EIR (Environmental Solutions, Inc., 1990a), and Final EIS/EIR (Environmental Solutions, Inc., 1990b). A summary of mitigation measures relevant to reclamation from the Draft EIS/EIR is shown in Appendix A: Reclamation Mitigation Measures. These measures are cross referenced with text in the Reclamation Plan.

2. The Castle Mountain Mine Plan and Reclamation Plan was compiled using the draft "Plan of Operations/Reclamation Plan Checklist for California Mining Operations of Federal (or a Combination of Private and Federal) Lands," and BLM's Manual Handbook Supplement: Surface Management of Mining Operations. Both documents offer the most comprehensive set of criteria ever established for reclamation activities in California. Although many of the topics in the Mine and Reclamation Plan are topics already discussed in the EIS/EIR documents, excerpts were inserted from the Draft EIS/EIR to create a complete and comprehensive document. Those not wishing to review the document in its entirety should refer to Chapters 1.0, 2.0, and 3.0, which are the heart of the Plan.

3. The Plan was developed with the assistance of BLM, California Division of Mines and Geology (Mine Land Reclamation Program), the County, California State University system (Desert Studies Consortium), environmental organizations, and western reclamation specialists. Never before has the successful cooperation of a number of diverse interests and groups been reflected in a mine and reclamation plan. Five initial meetings were held to formulate the Plan, resolve issues of concern, and to incorporate the knowledge and expertise of the contributors prior to developing a working draft. The working draft was distributed to interested parties to afford them the opportunity to offer comments for consideration. An additional ten meetings were held with the BLM, State, County, and members of the

environmental community to answer questions and resolve pending issues in the finalization of the working draft. Changes have been incorporated in the document to reflect the consensus of government agencies. In summary, a total of 15 separate meetings have resulted in the finalization of this document.

4. Viceroy recognizes with appreciation individuals who contributed to discussions that led to the completion of this section of the Reclamation Plan. They include (in alphabetical order):

• Ben Albrechtsen Regional Reclamation Specialist	U.S.D.A.* Forest Service 324 25th Street Ogden, UT 84401
• Bob Anderson Deputy State Director Mineral Resources	U.S.D.I.** Bureau of Land Management California State Office 2800 Cottage Way Room E-2915 Sacramento, CA 95825
• Elena Daly Chief, Resources Staff	U.S.D.I. Bureau of Land Management Needles Area Office 101 W. Spike's Road Needles, CA 92343
• Rick Everett Principal Investigator for Vegetation Analysis	California State University Desert Studies Consortium Department of Biology 5500 University Parkway San Bernardino, CA 92407
• Stan Haye Chairman	Sierra Club, CA/NV - Mining Committee c/o Assessor's Office Drawer J Independence, CA 93526
• Gerry Hillier California Desert District Manager	U.S.D.I. Bureau of Land Management California Desert District 1695 Spruce Street Riverside, CA 92507
• Ken McMullen Botanist/Ecologist	U.S.D.I. Bureau of Land Management Needles Area Office 101 W. Spike's Road Needles, CA 92363
• Diane L. Mitchell Reclamation Specialist and Consultant to the Sierra Club	1732 Country Club Dr. Bakersfield, CA 93306

• Steve B. Monsen Botanist	U.S.D.A. Forest Service, Great Basin Research Program Intermountain Forest and Range Experiment Station Shrub Sciences Laboratory 735 N. 500 E. Provo, UT 84606
• Bob Moon Chief of Resources Management	U.S.D.I. National Park Service Joshua Tree National Monument 74485 National Monument Drive Twentynine Palms, CA 92277
• Gail Newton Plant Ecologist, Mine Reclamation Program	State of California Department of Conservation Division of Mines and Geology 650 Bercut Drive, Suite B Sacramento, CA 95814
• James Pompy Manager, Mine Reclamation Program	State of California Department of Conservation Division of Mines and Geology 650 Bercut Drive, Suite B Sacramento, CA 95814
• Deborah Reames Attorney	Sierra Club Legal Defense Fund 2044 Fillmore Street San Francisco, CA 94115
• Norbert J. Riedy, Jr. Consultant	The Wilderness Society 116 New Montgomery, Suite 526 San Francisco, CA 94105
• Dr. Alan Romspert Desert Studies Coordinator	California State University Desert Studies Consortium, Department B Fullerton, CA 92634
• Dr. Roger Rosentreter State Botanist	U.S.D.I. Bureau of Land Management Idaho State Office 3380 Americana Terrace Boise, ID 83706
• Dr. Gerry Scherba Director	California State University Desert Studies Consortium, Department B Fullerton, CA 92634
• Randy Scott Senior Planner	County of San Bernardino Planning Department 385 N. Arrowhead, Third Floor San Bernardino, CA 92415
• Dr. Ross Virginia Associate Director	San Diego State University Systems Ecology Research Group San Diego, CA 92181-0401

*U.S.D.A. - United States Department of Agriculture
**U.S.D.I. - United States Department of the Interior

5. State-of-the-art reclamation activities will be conducted at the Castle Mountain Project site. They include:
   - Salvage operations for small to medium size Joshua trees and barrel cactus.
   - A nursery and experimental garden for salvaged plants and research activities.
   - Stockpiling salvageable seedbank and growth media material.
   - Contouring landforms to blend with the natural landscape.
   - A research program that will develop valuable information about reclamation on the semi-arid desert including irrigation, fertilization, herbivory, persistence of seed stock, transplanting, and others.
   - Voluntary backfilling and reclamation of two previously mined clay quarries.
   - A procedure for evaluating the success of reclamation has been developed.
   - An educational program for heavy equipment operators on state-of-the-art reclamation techniques.
   - A staged bond release, which is contingent on the completion of various reclamation activities.

6. The Plan will be administered in compliance with the Memorandum of Understanding (MOU) (see Appendix B) recently entered into between the BLM and the State Mining and Geology Board of the Department of Conservation, State of California. The MOU is for the purposes of:
   - Assuring the consistent application of adequate and appropriate reclamation throughout California.
   - Simplifying the administration of surface mining and reclamation practice requirements on Federal lands and on a combination of Federal and private lands.
   - Achieving coordination of activities governing reclamation.
   - Eliminating duplication among the aforementioned agencies and counties serving as Lead Agencies in implementing State and Federal reclamation requirements.

1.1.2 PURPOSE AND USE OF THE RECLAMATION PLAN

1. The purpose of this Plan is to provide detailed guidelines for implementing the reclamation process, to fulfill Federal, State, and County requirements. It will be used by regulatory agencies in their oversight roles to ensure that the reclamation measures to be implemented by Viceroy are, in fact, so implemented.

2. This Plan will be used by Viceroy to implement reclamation activities throughout the operational period of the project and subsequent to cessation of mining and processing activities. In turn, responsible agencies, including the BLM, County, and others, will use the Plan as a basis to review and evaluate the reclamation program.

3. As with any large, multi-year project, it is to be expected that there will be changes to planned reclamation procedures over the life of the project. These changes may result from permitted alterations of project activities, procedural changes in planned reclamation as a result of information developed by onsite revegetation research undertaken by Viceroy, research and studies performed elsewhere, and/or changes in Federal/State regulations. Viceroy will submit proposed revisions to the BLM and County for approval. Approved changes will then be incorporated into the Plan and implemented at the project site.

4. A mitigation compliance monitoring program, which provides for regular reports on project permit conditions and onsite inspections, has been developed for this project. It is anticipated that activities described in this Plan will be incorporated by reference as conditions of approval for the BLM's Record of Decision respecting the Plan of Operations for the Castle Mountain Project and the County's determination on the application for a Conditional Use Permit and Mining/Reclamation Plan Approval. Therefore, the performance criteria described herein will be subject to assessment as part of the mitigation compliance monitoring program. This program will provide a mechanism for regular and frequent evaluation of the status and progress of the reclamation program. In addition, enforcement procedures incorporated into the mitigation compliance monitoring program will provide a mechanism for enforcing the provisions of this Plan.

5. This Plan has been prepared as part of the environmental process and upon adoption will become a legally enforceable document. Performance of the activities described herein will be guaranteed by bonding, with the bond held jointly by the BLM and County .

1.1.3 STATUTORY AND REGULATORY REQUIREMENTS

1. Reclamation of areas disturbed by the Castle Mountain Project will comply with FLPMA, SMARA, and County requirements in order to minimize water degradation, air pollution, damage to aquatic or wildlife habitat, and erosion, while at the same time providing for a

continuation of existing uses including mining, livestock grazing, wildlife habitat, and recreation. This section of the Plan discusses measures Viceroy intends to employ in order to meet these objectives.

1.1.3.1 Federal

1. United States mining laws provide that a person has a statutory right, consistent with Department of Interior regulations, to go upon open Federal lands for the purpose of mineral prospecting, exploration, development, extraction, and other uses reasonably incident thereto. However, "this statutory right carries with it the responsibility to assure that operations include adequate and responsible measures to prevent unnecessary or undue degradation of the Federal lands and to provide for reasonable reclamation" (43 CFR 3809.0-6). On Federal lands administered by the BLM, it is the BLM's responsibility to ensure that mining operations are completed in conformance with these objectives and specific requirements. The 43 CFR Regulations define reclamation as follows:
   - "Reclamation means taking such reasonable measures as will prevent unnecessary or undue degradation of the Federal lands, including reshaping land disturbed areas so as to provide a diverse vegetative cover. Reclamation may not be required where the retention of a stable highwall or other mine workings is needed to preserve evidence of mineralization."

2. The 43 CFR 3809 Regulations state:
   - "Reclamation shall include but shall not be limited to:
     - Saving of topsoil for final application after reshaping of disturbed areas have been completed.
     - Measures to control erosion, landslides, and water run-off.
     - Measures to isolate, remove, or control toxic materials.
     - Reshaping the area disturbed, application of the topsoil, and revegetation of disturbed areas, where reasonably practicable.
     - Rehabilitation of fisheries and wildlife habitat."

3. Language addressing the preservation of the evidence of mineralization is stated as follows:
   - The regulations further state in Section 3809.1-3(d)(3):
     - "At the earliest feasible time; the operator shall reclaim the area disturbed, except to the extent necessary to preserve evidence of mineralization, by taking reasonable measures to prevent or control onsite and offsite damage of the Federal lands."

- Section 3809.1-3(d)(5) states:
  - "When reclamation of the disturbed area has been completed, except to the extent necessary to preserve evidence of mineralization, the authorized officer shall be notified so that an inspection of the area can be made."
- 43 CFR 3809.0-5(j) states:
  - "Reclamation may not be required where the retention of a stable highwall or mineworkings is needed to preserve evidence of mineralization."

1.1.3.2 State

1. SMARA (Section 2733) defines reclamation as:
   - "Reclamation means the combined process of land treatment that minimizes water degradation, air pollution, damage to aquatic or wildlife habitat, flooding, erosion, and other adverse effects from surface mining operations, including adverse surface effects incidental to underground mines, so that mined lands are reclaimed to a useable condition which is readily adaptable for alternate land uses and create no danger to public health or safety. The process may extend to affected lands, surrounding mined lands, and may require backfilling, grading, resoiling, revegetation, soil compaction, stabilization, or other measures."

2. According to SMARA (Section 2712(a)-(c)), the objectives of reclamation are to assure that:
   - "Adverse environmental effects are prevented or minimized and mined lands are reclaimed to a useable condition which is readily adaptable for alternative land uses."
   - "The production and conservation of minerals are encouraged, while giving consideration to values relating to recreation, watershed, wildlife, range and forage, and aesthetic enjoyment."
   - "Residual hazards to the public health and safety are eliminated."

   Further, SMARA (Section 2711(c)) observes that:
   - "[S]urface mining takes place in diverse areas where the geologic, topographic, climatic, biological, and social conditions are significantly different and that reclamation operations and specifications therefore may vary accordingly."

3. The requirements of Section 2772 of SMARA are listed below. Each requirement was addressed in the Plan of Operations submitted to BLM in 1988 and the Application for Mining Reclamation Plan Review and Site Approval (the term "Site Approval" was subsequently redesignated "Conditional Use Permit") submitted to the County Land Management Department in 1988.

- "The reclamation plan shall be filed with the Lead Agency on a form provided by the Lead Agency, by any person who owns, leases, or otherwise controls or operates on all, or any portion of any, mined lands, and who plans to conduct surface mining operations thereon."
- "The reclamation plan shall include the following information and documents:
  (a) The name and address of the operator and the names and addresses of any persons designated by him as his agents for the service of process.
  (b) The anticipated quantity and type of minerals for which the surface mining operation is to be conducted.
  (c) The proposed dates for the initiation and termination of such operation.
  (d) The maximum anticipated depth of the surface mining operation.
  (e) The size and legal description of the lands that will be affected by such operation, a map that includes the boundaries and topographic details of such lands, a description of the general geology of the area in which surface mining is to be conducted, the location of all streams, roads, railroads, and utility facilities within, or adjacent to, such lands, the location of all proposed access roads to be constructed in conducting such operation, and the names and addresses of the owners of all surface and mineral interests of such lands.
  (f) A description of and plan for the type of surface mining to be employed and a time schedule that will provide for the completion of surface mining on each segment of the mined lands so that reclamation can be initiated at the earliest possible time on those portions of the mined lands that will not be subject to further disturbance by the surface mining operation.
  (g) A description of the proposed use or potential uses of the land after reclamation and evidence that all owners of a possessory interest in the land have been notified of the proposed use or potential uses.
  (h) A description of the manner in which reclamation, adequate for the proposed use or potential uses will be accomplished, including:
    (1) A description of the manner in which contaminants will be controlled, and mining waste will be disposed.
    (2) A description of the manner in which rehabilitation of affected streambed channels and streambanks to a condition minimizing erosion and sedimentation will occur.
  (i) An assessment of the effect of implementation of the reclamation plan on future mining in the area.
  (j) A statement that the person submitting the plan accepts responsibility for reclaiming the mined lands in accordance with the reclamation plan.
  (k) Any other information which the Lead Agency may require by ordinance."

1.1.3.3 County

1. The County Development Code, in discussing the reclamation of mined lands, states that reclamation is intended to provide for the production and conservation of minerals, while giving consideration to values relating to recreation, watershed, wildlife, range and forage, and aesthetic enjoyment, and to provide for public health and safety (Section 812.0101). On private or patented lands within the County, it is the County's responsibility to ensure that mining operations are completed in conformance with Federal, State, and County objectives and specific requirements.

1.1.4 GOALS AND OBJECTIVES OF THE RECLAMATION PLAN

1. The goals and objectives of the Plan are as follows:
   - Ensuring that materials excavated during gold mining operations are placed in a manner that will not pose a hazard to public health and safety, are in a naturally appearing configuration, and that will minimize subsequent shaping and recontouring needed to avoid erosion. It will also facilitate revegetation activities on disturbed areas as an integral and concurrent function of the mining and reclamation program.
   - Implementing a revegetation program that will establish plant communities with species composition and plant densities similar to those existing on undisturbed areas at the project site today. The objective being to establish the biological and physical conditions needed for plants to grow without continued cultural inputs such as irrigation, tillage, or fertilization subsequent to the completion of mining operations.
     - Implementation of the revegetation plan should demonstrate a good faith effort to revegetate to the type of vegetation previously found at each kind of disturbed site (i. e., compaction due to roads and buildings, overburden, and heap leach pile areas).
     - Revegetation should involve the exclusive use of native plant species known to occur in the East Mojave Desert and active exclusion of exotic species throughout the duration of the revegetation effort.
     - The revegetation plan should provide not only for the planting and transplanting of diverse plant species, but should prepare each kind of site in such a way as to enhance the likelihood of successful natural revegetation.
   - Enhancing the visual appearance of the area by reclaiming the existing clay quarries (which predate reclamation requirements imposed under SMARA) as an integral part of the reclamation program for the Castle Mountain Project.
   - The revegetation plan should contribute to improving the viewscape by eliminating rock scars caused by excavations and road cuts. This can be accomplished by integrating revegetation plans with those for the application of rock coloring and contouring.

- The revegetation plan should include the provision of microhabitats which would provide cover and nesting opportunities for desert vertebrates.
- The revegetation plan should develop quantitative goals in terms of plant diversity and density, which can reasonably be expected to occur once the mining operation has ceased, the revegetation plan has been implemented, and a reasonable number of years has elapsed to permit natural revegetation to occur.

1.2 POST-MINING LAND USE

1.2.1 LAND USE

1. The Lanfair Valley area is zoned as multiple-use Class L (limited) by the BLM. Mining is one of the multiple-use activities allowed in Class L zones. Mining is also allowed under the County zoning regulations. Considerable evidence of past and present mining activity exists at the project site. Remnants of the abandoned mine workings and mining town of Hart, including mine adits, the ruins of head frames and milling facilities, and other mining structures can be seen. Two clay quarries are located on or near the site. These were mined for clay, which was used in the manufacture of ceramic products. Drill access roads associated with Viceroy's ore delineation program are also evident.

2. The project site is located within the BLM's Lanfair Valley grazing allotment, which encompasses about 470,000 acres, 75 percent being Federal (BLM) land. The allotment is divided into five pastures, among which livestock are rotated during the year to maintain productive rangeland. The project's entire surface disturbance will represent less than 0.3 percent of the grazing allotment in Lanfair Valley.

3. Recreational use at the project site is expected to primarily involve informal uses such as sightseeing. The remains of past mining activities at Hart attract sightseers, rockhounds, and other recreationists. The Hart townsite and mining history are referenced in the East Mojave Heritage Trail guidebook, which is available to off-highway vehicle recreationists. Shooting and hunting also may occur.

4. The nearest occupied residences are at the OX Ranch, nine miles southwest and two houses at Barnwell, 8.5 miles west.

5. No portion of the project site is within an area designated as a Wilderness Study Area (WSA), but two WSAs are located in this portion of the East Mojave National Scenic Area (EMNSA).

These are shown in Figure 1.1 (Lanfair Valley Recreational, Environmental and Wilderness Management Features):

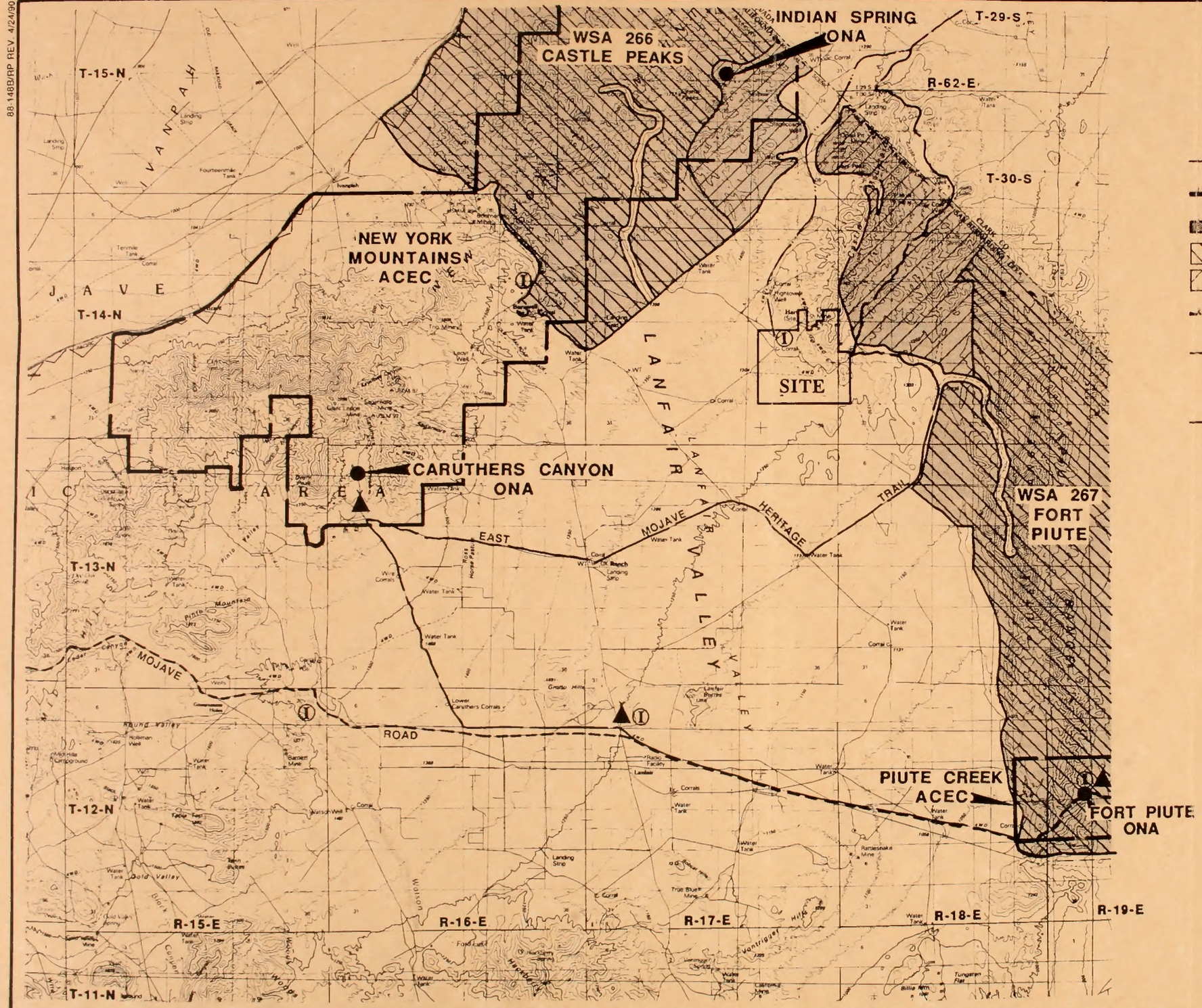
- Castle Peak (CDCA-WSA #226) lies to the northwest of the project. It contains approximately 44,160 acres. The southeastern portion of the WSA has been recommended by the BLM as not suitable for wilderness designation. The abandoned right-of-way for the Barnwell and Searchlight railroad forms the southern boundary of this WSA from Barnwell eastward almost to the Nevada border.
- Fort Piute (CDCA-WSA #267) lies to the east of the project and contains approximately 37,561 acres. Portions of this WSA to the east and northeast of the project site over to the Nevada border have been recommended by the BLM as not suitable for wilderness designation (BLM, 1988).

6. The Castle Mountain area and specifically the historic Hart Mining District has been mined almost continuously for gold or clay values over the last 80 years, as discussed in the Draft EIS/EIR (Section 4.9). Improved technologies, more sophisticated equipment, and the demand for gold have been the driving factors in the successive phases of mining in the Hart Mining District.

7. The population of Hart swelled to as many as 700 people in the initial gold mining boom in 1907 - 1910. There were also a number of homesteads settled throughout Lanfair Valley in the early part of this century. Remnants of the Hart townsite and homesteads in the valley can still be seen today, although the North Clay Pit area has expanded over the years to the point that it now covers most of the original townsite of Hart. The South Clay Pit area has been mined since the early 1920s as a source of materials for the production of ceramic products. Clay production has been as much as 200,000 tons annually. The clay quarries are prominent landmarks in northern Lanfair Valley (see Figure 1.2, Aerial Photograph of Castle Mountains).

8. The project site is located within the Hart Mining District. Exploratory drilling by Viceroy has delineated three gold deposits for development, and has also disclosed the presence of several zones of mineralization in the vicinity of these deposits. This latter mineralization is uneconomic to mine under present conditions, owing to the overburden/ore ratio, which results in excessive mining costs. Given historic trends in the mining industry, it is possible that more efficient technologies will evolve. If these are coupled with a relative improvement in the price of gold, mining these mineralized zones would be feasible.

88-148B/RP REV. 4/24/90



LEGEND

- PROPOSED ACCESS ROAD
- AREAS OF CRITICAL ENVIRONMENTAL CONCERN (ACEC) BOUNDARY
- WILDERNESS STUDY AREA
- BLM SUITABLY RECOMMENDED WSA
- BLM RECOMMENDED AS UNSUITABLE
- PROPOSED NATIONAL RECREATION TRAIL (MOJAVE ROAD)
- INTERPRETIVE TRAIL (EAST MOJAVE HERITAGE TRAIL)
- OUTSTANDING NATURAL AREA (ONA)
- EAST MOJAVE NATIONAL SCENIC AREA BOUNDARY
- VISITOR INFORMATION INTERPRETIVE SITES
- PRIMITIVE CAMPING AREAS

BASE REFERENCE: U.S.G.S. 30 x 60 MINUTE SERIES TOPOGRAPHIC MAPS OF IVANPAH, CALIFORNIA, AND DAVIS DAM, NEVADA, BOTH DATED 1985

SOURCE: EAST MOJAVE NATIONAL SCENIC AREA MANAGEMENT PLAN 1988

0 2 4 MILES
SCALE

CONTOUR INTERVAL: 50 METERS

FIGURE 1.1

LANFAIR VALLEY RECREATIONAL, ENVIRONMENTAL, AND WILDERNESS MANAGEMENT FEATURES

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION



This photograph of the southern Castle Mountains was taken from a point above the western portion of the proposed Castle Mountain Project site. Hart Mine Road leads to former Hart townsite and active clay pit at left center. Road in foreground leads to Big Chief Hill clay pit at right. Other roads on hills at center lead to former mine workings and exploratory drilling sites. View northeast.

FIGURE 1.2

AERIAL PHOTOGRAPH OF CASTLE MOUNTAINS

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

1.2.2 POST-MINING LAND USE

1. Uses of the site include mining, recreation, grazing, and wildlife habitat. The latter three uses will be temporarily interrupted or altered on approximately 1,500 acres. Fencing and gating will restrict access by the public, cattle, and wildlife for the duration of the Castle Mountain Project, and for several years thereafter, while newly revegetated areas recover without disturbance.

   - **Recreation** - Most visitors to Hart travel there to see the abandoned townsite and remnants from previous mining operations. These are discussed in *East Mojave Heritage Trail, Ivanpah to Rocky Ridge* (Casebier, 1988), as the trail described in that book passes through the area. Viceroy will cooperate with BLM in establishing an interpretive center to explain responsible multiple use of the desert region, with a focus on mining issues. Decommissioning procedures described elsewhere in this chapter will ensure that after project termination the site will not present a hazard to visitors. One of the six management goals adopted by the EMNSA Plan is to enhance resource values by adding appropriate improvements, such as water. The water supply being developed by Viceroy is of good drinking water quality. Recreational needs for visitors to northern Lanfair Valley could be readily supplied from one of these wells.
   - **Grazing** - During the reclamation process, fencing will be used to exclude cattle from revegetated areas. At project termination, BLM will be asked to designate which well is desired for recreational, wildlife guzzler, and stock watering purposes.
   - **Wildlife** - in the area is typical of the eastern Mojave Desert, especially for species associated with the dominant creosote bush scrub and Joshua tree woodland habitats. Disturbances at the site will be a fraction of one percent of this type of habitat in Lanfair Valley. Accordingly, removal of this habitat pending reestablishment of vegetation on disturbed sites is not expected to have a significant impact on wildlife. With the possible exception of the desert tortoise, there are no threatened or endangered wildlife species present. The U.S.D.I. Fish and Wildlife Service (FWS) issued a "No Jeopardy" Biological Opinion for the Castle Mountain Project regarding the desert tortoise in August, 1990. Surveys undertaken in connection with the Biological Opinion showed only six burrows at the site that could possibly be tortoise burrows. None of them were occupied, and none showed any sign of recent use by tortoises. The burrows are located away from areas to be disturbed by the project.

2. Mining will be an appropriate second use of the project site, and the project's reclamation program will be implemented in a manner that will not overly restrict or impede such future use. Gold mineralization is disseminated at the Castle Mountain site, with no sharp physical demarcation between ore and overburden. In such circumstances, the material is mined to an economic "cut-off" grade. Mineralization in the walls and floor of the pit will contain gold in concentrations which are uneconomic to mine under current conditions. However, future

improvements in technology (or lower unit costs that might be achieved with improved technology) and/or a higher gold price would allow the operator to mine these areas and increase the ultimate recovery of the resource.

3. Post-mining land uses of the site will be controlled by the following factors:
   - Compatibility with adjacent land uses
   - Zoning restrictions
   - County general plans
   - Post-mining topography

4. These factors are discussed briefly, as follows:
   - **Compatibility With Adjacent Land Uses** - The EMNSA Plan encourages mineral development consistent with the principles developed in the Mining and Mineral Policy Act, 1970 (30 U.S.C. 21a). The plan supports continued mineral development within the East Mojave Desert as an extension of long-standing activity that has helped to define the character of the area. Desert land use policies under the County's General Plan encourage uses compatible with the open, rural character (e.g., ranching, agriculture, and mining) of the desert environment, which improve the economic base of the desert.
   - **Zoning Restrictions and County General Plans** - BLM administered lands in Lanfair Valley are designated as Multiple Use Class-L (limited) lands. Mining, livestock grazing, recreation, and wildlife habitat are all activities authorized in Class-L lands. The County has designated the Castle Mountains as a Mineral Resource Zone 2 area, to ensure that other forms of development proceed in a manner that is compatible with the presence of significant minerals. The County also requires that the minimum size of tracts for homesites is 40 acres. The amount of privately-owned land within a five to eight-mile radius of the project site (other than for patented mining claims) is minimal. Most surrounding land is owned by the Federal government, as is most of the project site itself. Real estate development does not appear to be a realistic post-mining land use, given ownership and zoning restrictions.
   - **Post-Mining Topography** - Project site topography after the project has ended is discussed in Section 1.10.1. Materials will be placed to ensure long-term stability of overburden and spent ore piles. Final topography will minimize erosion and sedimentation, and assist in revegetation efforts.

5. Within the site boundaries, the only owners of possessory interests (other than Viceroy) are persons who have entered into long-term lease agreements with Viceroy in anticipation that their properties will be developed as part of the Castle Mountain Project. Those owners of possessory interests have been notified of the proposed uses or potential uses after reclamation.

1.3 EVALUATION OF RECLAMATION SUCCESS

1. Devising a method to evaluate the success of revegetation efforts on site has been by far the most difficult task in the development of the Plan. After discussions with representatives of the BLM, State, County, the Desert Studies Consortium, and reclamation specialists, it became apparent that a quotient for success has not previously been established for semi-arid desert revegetation efforts. Although many operations have developed reclamation plans for revegetation in the California desert, a qualitative evaluation of success has not been developed, largely due to the difficulty of establishing a goal when research data has not been collected in this area. These previous plans have utilized a "best efforts" concept without attempting to quantify plant densities or species diversity. Therefore, establishing an evaluation of success for the Castle Mountain Project on the basis of plant densities and species diversity is a pioneer effort.

1.3.1 SETTING AN ACHIEVABLE GOAL

1. The Castle Mountain Project has established two parameters which will govern bond release. For this reason, it is important that the evaluation be based on site specific scientific data, rather than an arbitrary number established for other areas which may have higher rainfall. Once achieved, the revegetation portion of the reclamation bond will be released to Viceroy.

2. An achievable goal is important not only from the standpoint of the release of the monetary investment made by the company, but also from the BLM, State, and County's perspective. An achievable goal will promote reclamation research in the semi-arid desert. If the permittee has an opportunity to meet and/or exceed this goal based on economic incentive, valuable information can and will be established. If the permittee is set up for failure through the establishment of an unrealistic, arbitrary or unreasonable goal, there is more incentive for industry, as a whole, to negotiate for the lowest possible bond amount and forfeit the bond at the conclusion of the project, realizing that the goals set by the BLM, State, and County can never be achieved.

1.3.2 ESTABLISHING A TIMEFRAME FOR RECLAMATION SUCCESS

1. Revegetation of semi-arid areas usually proceeds very slowly, especially during periods of drought, but can be expected to improve as a result of the nurse-plant effect. Establishing

viable populations of shrubs, grasses, and forbs from seed may take several growing seasons. To establish a timeframe for reclamation success, professors associated with the Desert Studies Consortium of the California State University system were asked to evaluate a reasonable period of time for the establishment of native species to be used in reclamation.

2. The professors made an evaluation based on three, five, and ten years for the successful establishment of vegetation on reclamation areas. Three years were considered the minimum amount of time to establish reclamation success on the semi-arid desert, based on average conditions of temperature and climate. Since average conditions rarely occur in the semi-arid desert, a timeframe of five years was considered a more appropriate period of time over which to evaluate the success of the revegetation on site.

3. Bearing in mind that initial reclamation efforts will commence during the first stage of a 10-stage project which will encompass ten years of operation, ten years was considered too long a post-operation reclamation monitoring phase. A 5-year post-operation monitoring period was considered sufficient. Quantitative and qualitative data will be collected annually on each area reclaimed. Therefore, Stage 1 reclaimed areas will ultimately be assessed over a period of at least 14 years, assuming that reclamation takes place in the latter part of the first year of operation, and areas reclaimed in Stage 9 will be evaluated for a period of six years. Table 1.1 (Timeframe Established for Reclamation Success) shows the approximate number of years associated with each stage, for the determination of reclamation success. Each stage is approximately one year.

1.3.3 ESTABLISHING A RATIONALE FOR EVALUATING REVEGETATION SUCCESS

1. The techniques that will be used to maximize the likelihood of successful revegetation are discussed in Section 1.5., but what kinds of measures can be employed to evaluate the success of these efforts in quantitative terms?

2. It is important to establish a realistic rate for revegetation based on quantitative data. The rate recommended is a proportion of the density and diversity that is currently found on several undisturbed sites at the Castle Mountain Project. It is expected that this rate, after a period of

TABLE 1.1

TIMEFRAME ESTABLISHED FOR RECLAMATION SUCCESS (Years)

RECLAMATION STAGES	APPROXIMATE NUMBER OF YEARS EVALUATED FOR RECLAMATION SUCCESS
Stage 1	Fourteen (14)
Stage 2	Thirteen (13)
Stage 3	Twelve (12)
Stage 4	Eleven (11)
Stage 5	Ten (10)
Stage 6	Nine (9)
Stage 7	Eight (8)
Stage 8	Seven (7)
Stage 9	Six (6)
Stage 10	Five (5)

88-148B (8/21/90)

years, will be an accurate prediction of successful revegetation after the project has ceased. The ultimate goal is to have the site revegetate as closely as possible to the conditions of pre-existing vegetation.

3. As a first approximation in defining revegetation success, the known rate of natural revegetation, as determined from certain dated sites (i.e., the South Clay Pit adjacent to the mine site, which is no longer being worked and the townsite of Hart, known to be abandoned since 1918) can be used after adjustment for the deviation from the long-term average annual rainfall. This information will provide the plant density and diversity achievable under the rainfall regimen during that period. To establish the rate, the results of up to 70 years of natural local revegetation was used, adjusted each year for differences in the number of years of induced revegetation, and for differences in rainfall experienced. For example, after five years, induced revegetation at the mine site would be expected to be at least 5/70 of the revegetation achieved at Hart, adjusted upward or downward depending upon the average annual rainfall experienced during those five years.

4. With irrigation, fertilizer, and other possible amendments added to revegetated areas and based on the findings of the revegetation research program, the rate established should exceed the 5/70 used as a first approximation. The results of these efforts should increase the rate of expected natural revegetation, although it is difficult to establish a specific rate with any accuracy.

1.3.4 DENSITY AND DIVERSITY AS DETERMINING FACTORS FOR RECLAMATION SUCCESS

1. A number of factors can be used to evaluate reclamation success. The Desert Studies Consortium recommends density and diversity of perennial species as the measures to be used onsite. The rationale for this selection was based on the fact that density and diversity are easily measured and readily quantifiable factors, that are ecologically meaningful when compared to undisturbed sites.

2. Density is the number of plants per unit area. Vegetation density of perennial species in revegetated areas will be compared to the density of perennials measured on undisturbed plots. Reclamation success will be evaluated, in part, based on this comparison.

3. Realizing that vegetation density as a single factor could fail to produce an accurate reflection of reclamation success, plant diversity of perennials will also be used to evaluate revegetated sites. Plant diversity is the number of different species per unit area. Plant diversity of perennials in revegetated areas will be compared to the diversity of perennials found on undisturbed sites. This comparison will provide a measure of success for the reclamation program.

4. Concern has been raised that plant diversity may not be achieved as easily as expected over the life of the project. Many native plant species fail to germinate until the right conditions prevail. Some species have been known to maintain their viability for ten years or more before germinating. Therefore, the success of reclamation in terms of plant diversity will depend upon the optimal set of conditions to enhance plant density and diversity, which will be established in the reclamation research program. With a diversity of native species found in the seed mix and the establishment of transplanted species which have been salvaged from the site, the Consortium expects that plant diversity, at the rate indicated above, should be an achievable goal over the established timeframe. Diversity is also expected to increase over time, due to the nurse-plant effect.

5. Cover was also considered as a factor for reclamation success. Research on the arid desert shows that reclaimed arid lands usually recover in terms of percent cover faster than species composition (Webb *et al.*, 1983). The Consortium has indicated that this may not be true for perennials on semi-arid lands. Cover of perennials measured during the early stages of reclamation in the semi-arid desert are expected to yield a very low percentage during the first several years of growth. Survival of semi-arid species is based on low transpiration rates during the first several years of growth. Semi-arid species, therefore, initially have a high root-to-shoot ratio, reducing the amount of transpiration in the early years of plant establishment. For this reason, the Consortium does not recommend cover as an accurate reflection of reclamation success during the early years in the semi-arid desert. However, cover will be measured on an annual basis with density, diversity, and other measurements such as shrub height, to establish valuable baseline data for future research.

1.3.5 PERFORMANCE GOALS

1. Success of the revegetation program will be determined by measuring two parameters, density and diversity of perennial species. These parameters will govern bond release. The parameters will be based on a percentage recovery when compared to perennial species found on representative, relatively undisturbed, control sites (In view of the area's long history of grazing it should be realized that no control sites would be completely undisturbed). The 10-year goal for density, using only perennial species, will be 21 percent of the control. Using a sigmoidal curve, the 5-year goal for density will be six percent of the control. The 10-year goal for diversity using only perennial species will be 15 percent expressed as a similarity index of the control. The 5-year goal for diversity, also based on a sigmoidal curve, will be four percent expressed as a similarity index of the control.

2. A similarity index measures the conformity of one multi-species population to another. It is a similarity measure between two stands of vegetation which provides information about the numbers of species common to both, relative to the total number of species occurring in one stand or the other. The more species in the common the higher the similarity index (Causton, 1988).

3. The diversity and density measurements will be based on randomly selected plots located within areas representative of the lands being reclaimed. Annual revegetation reports will be prepared that, at a minimum, include the following sections: introduction, methods and materials, results, discussion and summary, and recommendations for remedial actions or future trials. The data collected from the annual reports, and onsite reviews by agency representatives, may be used to adjust the density and diversity goals, to reflect appropriate site-specific rates of recovery.

1.4 REVEGETATION RESEARCH PROGRAM

1. From the perspective of vegetation, the semi-arid desert is both well-known and unknown. It is well-known in a floristic sense; that is; the distribution and co-existence of species are reasonably well documented. It is unknown in the sense that quantitative data on the composition of vegetation at the level of species, life forms or functional groups are generally lacking (Barbour and Billings, 1988).

2. Because deserts show extreme variation, both biotically and abiotically, over time spans of one year or less, long-term ecological research of even a simple monitoring nature must be conducted (Barbour and Billings, 1988). To truly understand the causes of the structures and functioning of the semi-arid desert, more data must be accumulated to permit correlations between vegetation characteristics and physical factors.

3. The Consortium will act as an outside consultant to Viceroy. The Consortium has surveyed the flora at the project site to establish baseline data. These surveys will be conducted at regular intervals throughout the duration of the project. The Consortium will also design experiments for a research program. As a result of this research program, revegetation procedures will be defined for the project-site area.

4. The Revegetation Research Program to be conducted through the Consortium will provide valuable research information. This information will be used to establish methods for successful reclamation and can also lead toward a more accurate prediction of revegetation success. The Consortium's proposal is found in Appendix C, Guidelines for the Development of a Revegetation Plan. Research results that have practical application for the Castle Mountain Project and are consistent with cost parameters established for reclamation activities will be implemented. Other research results (such as the use of geotextiles which have limited applicability to the project) will not be implemented onsite, but may be published by the Consortium. A summary of research activities and methodologies is presented below:

   - **Seed Availability** - Local seed sources are desirable since ecotypic variation (local genetic variability) may be high. A seed collection plan for the site will be developed after review of the literature of data on the timing of seed development and maturity for the key species listed in the revegetation plan.
   - **Trials for the Establishment and Persistence of Seed and Nursery Stock** - An experimental garden and nursery will be established onsite to evaluate the establishment and persistence of seed and nursery stock from commercial sources and those collected locally. The performance of seeded species will be evaluated by measuring the germination and long term viability of that species. Cuttings will also be evaluated for use. A seed collection plan will be developed indicating optimal times for seed collection, development, and maturity. Trials will establish the germination percentage of the seed which can be expected under field conditions.
   - **Trials on Nursery Equipment and Inoculations** - Information will also be gathered on the selection of containers for good root system development, potting media, inoculation recommendations for micorrhizal fungi, and fertility management for the production of plants with high root/shoot mass ratios.

- **Transplanting Procedures** - The experimental garden and nursery will primarily be used for transplanted stock. Different species will be evaluated for their ability to survive transplanting. Test plots will also be used to evaluate the effect of slope, angle, elevation, and aspect on revegetation of various locations at the project site.
- **Hardening Protocol for Nursery Grown Stock** - Nursery grown stock will be stressed prior to its onsite establishment. A hardening protocol will be established to wean plants from irrigation, shade, fertilization, etc.
- **Field Trials on the Successful Transplant of Wildings** - The transplant of wildings will be evaluated using native species growing within the project boundaries on areas that will be disturbed. Survivability will be documented using several different kinds of species.
- **Laboratory Experiments on Viability and Germination of Seedbank Material** - The germination and viability of seed stockpiled in seedbanks over time and from varying depths should provide valuable information about seed banking in the North American desert environment.
- **Field Trials Using Fertilizers** - Fertilizers and soil amendments will be applied to test plots at rates which will be established through soil testing. Application rates and the frequency of application will vary on different test plots.
- **Mulch Field Trials** - Test plots using mulches on steep slopes will be established to determine the degree of protection they provide to the soil surface from wind and water erosion. A variety of mulches, including crimped mulches, will be used on test plots of varying slopes to cover the soil surface and reduce wind velocity at the surface. Test plots will also indicate the reduction of water erosion by slowing run-off.
- **Irrigation Field Trials** - Supplemental irrigation will be used onsite where practical and feasible. Test plots will be established to determine rates, frequency, and types of irrigation.
- **Herbivory** - Cages will be placed over species that evidence a high degree of herbivory. The effectiveness of the caging technique will be evaluated.
- **Heap Leach Substrates** - Test plots will be established to determine if modifications to the substrate are necessary for plant growth on heap leach pads.

Documentation of both successes and failures arising from the Revegetation Research Program will be made available to government agencies and the general public, when sufficient information is collected to conclude investigations on the components of the program.

1.4.1 VEGETATION INVENTORY

1. The Consortium has surveyed existing flora within and adjacent to the project site. The sites surveyed include:
   - The Hart townsite, former roads, and building sites.
   - Overburden piles accumulated from the South Clay Pit.
   - Undisturbed, but grazed onsite grassland.
   - Undisturbed, but grazed Joshua tree woodland onsite.
   - Onsite slopes with blackbush.
   - Future sites of heap leach pads.
   - Future locations of overburden.
   - Future locations of onsite buildings and roads.

2. A grid survey with 200 meter intervals was used to sample the site. At each intersection of grid lines, a circular plot (10 meter diameter) was established to determine the kinds of species present. Two hundred ninety such grid intersection plots were established.

3. From the 290 plots, a detailed vegetative analysis will be performed on 45 plots. The analysis will include data on density, diversity, and related biometric information.

4. The 45 plots chosen for detailed analysis will provide a 90 percent confidence level. The plots selected will be photographed and permanently marked, so they can be remeasured, at a minimum, in Years 0, 1, 2, 4, 7, 10, 13, and 15 (Newton, 1990).

5. The information collected will be used to establish revegetation goals for the reclamation program and assess revegetation progress in the future.

6. Sensitive plant populations discovered within the site boundaries will be examined as part of the vegetation inventory. Populations of sensitive plans will be flagged, fenced or clearly delineated to ensure avoidance during construction and operations. Changes in spatial distribution and abundance will be compared, to evaluate the effect of the operation on the sensitive plant population over the life of the mine.

1.5 GENERAL CRITERIA FOR RECLAMATION

1. Revegetation will be an integral part of the reclamation process for the Castle Mountain Project. Whenever practicable, reclamation at the project will be conducted concurrently with mining activity, and therefore, revegetation will be of higher quality, more quickly achieved.

2. Land shaping of excavated materials to a naturally appearing configuration will be conducted. Heap leach piles and overburden piles will blend as much as possible, with the existing landforms.

3. Soil surface conditioning, both physical and biological, is vital for successful reclamation. Also species selection, seed collection, planting techniques, fertilization, irrigation, and controlling herbivores are all important components of a successful revegetation effort. The earlier a successful stand of vegetation is established on reclaimed land, the less adverse impact there will be from external factors, such as wind and water erosion. Therefore, efforts will be directed at revegetating areas as expeditiously as possible.

1.5.1 EDUCATIONAL PROGRAM FOR HEAVY EQUIPMENT OPERATORS

1. Employees operating heavy equipment for the purpose of reclaiming the project site will be required to attend an educational session on reclamation techniques, including land shaping, vegetation and soil salvage, seedbank preparation, soil stockpile preparation, contouring, placement of soil and seedbank materials, the value of an undulating topography, and seeding. Performance reviews will be linked, in part, to operator adherence to these procedures.

1.5.2 EXPERIMENTAL GARDEN AND NURSERY

1. An experimental garden and nursery will be established onsite for the purpose of evaluating establishment and persistence of seed and nursery stock. The nursery will be used primarily for transplanted species. Cuttings will also be propagated in the nursery.

2. Secondary uses for the nursery will be the propagation of seed or seedlings collected both locally and from other areas. Seeded species will be evaluated by measuring the germination and long term viability performance. Test species will be ranked according to how well they perform in the garden. The objective is to obtain valuable information for final revegetation activities.

1.5.3 SALVAGE AND TRANSPLANTING

1. Before salvaging operations will begin, the access road and project site will be "swept" for desert tortoise. Desert tortoise will be relocated. A detailed investigation was completed by the BLM in March 1990, of the onsite burrows that were described in the Draft EIS/EIR

(Section 4.5.2.2, Desert Tortoise) and identified in the Supplement (Section 3.1.1.2, Project Site Tortoises). The purpose of this investigation was to ascertain the actual use by tortoises of burrows previously found on the site. Each burrow was visually inspected to its terminus using either natural light and mirrors, or a fiber-optic scope. Of the 45 burrows located onsite and adjacent to the site, 39 were found to be attributable to animals other than the tortoise, and six were determined to be appropriate for potential use by tortoises. However, there was no evidence of tortoises such as shells, scat, or other sign, to indicate these six burrows were in use. Since tortoises would normally be inactive and found in their burrows at this time of year, it was concluded that their occurrence at the project site is very low. This finding is consistent with the known distribution of the desert tortoise, which is primarily found at elevations below 4,100 feet, whereas the project site is located above 4,200 feet.

2. The Draft EIS/EIR states that a goal would be to transplant at least 25 percent of the barrel cactus and 25 percent of the Joshua trees. This goal will be implemented depending on availability of suitably-sized plants onsite. In this regard, research from Joshua Tree National Monument shows that Joshua trees ranging in size from 3 to 10 feet, unbranched or with few branches, have the highest degree of transplant success.

3. Small to medium sized shrubs will be salvaged and transplanted in the nursery for future revegetation activities. Seed will be collected from unsalvageable material. Mojave yucca, buckhorn cholla, beavertail cactus, pancake prickly pear cactus, and other specimens may also be salvaged, depending on their survivability which will be evaluated in the Revegetation Research Program. Salvaging will be a recurring activity, and will be the first work to be done on sites that will be disturbed as the operation expands over the mine's life. These expansions are discussed in Section 1.6. Additionally, in coordination with BLM, interested groups and individuals will be offered a 2-week period in which to recover these species from areas to be disturbed during the initial site clearing for Stage 1. Public collection will be allowed after Viceroy has selected specimens for its reclamation program. Access to salvage sites will be controlled by BLM.

4. Barrel cacti will be marked in some noninjurious manner to indicate their north side before they are removed. After removal from their in situ position, the plants will be stored in a shaded area for at least one week, to allow bruised roots to heal. The cacti will then be replanted in the proper orientation and given water containing vitamin B-1 to promote root growth.

5. Test plots for container-grown stock and cuttings are proposed as part of the experimental garden so that overall viability and optimal density can be assessed. Container-grown plants will be established in the nursery in small pots or tubes containing potting medium. After they reach a certain size in the nursery, they will be transferred to a hardening shelter.

6. Container-grown plants will be transplanted in the early spring (late March or April). Ideally, the plants will be transplanted before they have broken dormancy. If spring moisture is limited, planting may be delayed until late May to take advantage of the July/August rains. In such cases supplemental irrigation may be required to ensure establishment.

7. Containerized stock will be watered and fertilized, if necessary, before planting by hand on final reclamation areas. Care will be taken to ensure that container-grown plants are sufficiently hardened, do not dry out prior to planting, and are adequately watered when planted.

8. Wildings are individual plants that are removed from nearby natural communities and immediately transplanted onto a disturbed site (Forest Service, 1979). Transplanting wildings is a successful method for establishing plant cover and increasing biological diversity. This technique takes advantage of locally adapted populations and does not introduce new species or foreign genetic material into the area.

9. The Castle Mountain Project will use selected wildings to increase diversity by planting shrub species. Transplanting wildings will have little long-term impact on the natural communities from which plants are to be removed. The density of natural stands will remain the same, and because only small plants will be moved, no visual impacts on the natural communities will be apparent.

10. Herbivory has been problematic at other reclamation sites in southern California. Cages will be placed around transplanted stock to prevent herbivory, if necessary.

1.5.4 SEEDBANK ESTABLISHMENT, SOIL SALVAGE, AND HANDLING

1. Physical alteration of the soil at the project will occur as a result of surface disturbances caused by mining. Texture, structure, stone content, color, and water-carrying characteristics will likely be affected by these activities.

2. The amount and quality of replaced soils will have a strong effect on the future site productivity of reclaimed lands (USDA R4 Reclamation Guide). In a series of studies, Goodall and his co-workers (Goodall *et al.*, 1972; Childs and Goodall, 1973; Goodall and Morgan, 1974) counted the seed reserves in soils of North American deserts. They observed a considerable difference in the depths of seed found. Whereas many seeds were concentrated on the surface, other seeds were predominantly found 1 to 2 cm deep (Goodall and Perry, 1979). As a result of these findings, the top layer of soil in the Administration Area will be salvaged as seedbank material for evaluation in the Revegetation Research Program. Seedbank material will be stockpiled separately from growth media material. Stockpiled seedbank and growth media material will be seeded to prevent infestation with weeds.

3. Growth media will be salvaged from areas to be disturbed by project development. The quantity of growth media available for salvage has been estimated from an assessment of its distribution within the 890 acres slated for development. Areas and estimated depths where salvage will be done are shown in the soils report, Appendix E, Soils Report. The total volume of growth media salvageable will be approximately 992,000 cubic yards, or 615 acre-feet.

4. Seeds from the most arid regions retain their viability for the longest period (Went, 1969). However, minimizing the time growth media remains in the stockpile is known to reduce mortality of soil microorganisms, increase seed viability and facilitate revegetation efforts. In recognition of this, Viceroy will: (1) keep the sizes of areas to be disturbed to a minimum prior to the time the areas are needed for operations, by staging their development, and (2) spread growth media on disturbed areas and revegetate as early as practicable. Trials will be conducted to determine the viability of stockpiled seed at various depths, over time.

5. Handling of soils exerts a decided influence upon pore space (Brady, 1974). Vehicles, heavy equipment, and shallow blading can all contribute to compaction. Excessive compaction of growth media is to be avoided. Since compaction impacts will generally be greatest in late winter and spring when soils are wet, minimizing growth media handling during that time of year will reduce reclamation costs and contribute to a successful revegetation program.

6. Growth media will be protected from erosion by seeding, contouring, shaping, and mulching, if needed.

1.5.5 LAND SHAPING, OVERBURDEN HANDLING, AND PLACEMENT

1. Land shaping and contouring are key features of the Reclamation Plan. Materials excavated during operations will be placed in a naturally appearing configuration, as generally described in Chapter 2. Landforms will be rounded to blend with the existing landscape.

2. Final overburden handling has a direct and substantial effect on reclamation success. Creating special subsurface features and special handling techniques for overburden will improve reclamation, and will be used onsite.

3. In order to establish conditions that will permit plant growth, care will be taken in placing overburden to provide contours and undulations for drainage, and to establish microhabitats that will support plant diversity and wildlife.

4. A final lift of material on overburden disposal areas will be "layer dumped" over the surface of the overburden pile to minimize compaction. The surface will be scarified or otherwise treated to eliminate smooth surfaces between overburden and growth media and to allow roots to penetrate into overburden material.

1.5.6 SOIL ISLANDS

1. It has been demonstrated on other sites that a thin layer of topsoil over a fair or poor quality subsoil, over spoil material (overburden) will give greater plant production than using the thin layer of topsoil alone (Albrechtsen, 1986). In the project area, there is very little topsoil. Nevertheless, growth media will be salvaged from sites scheduled for disturbance, as discussed in Section 1.5.4.

2. Since the total volume of growth media salvageable will be less than the total replacement volume desired, "soil islands" will be established on the disturbed areas to maximize the benefits from the limited amount of salvaged material that will be available. A "soil island" is a pocket of growth media with the greatest depth in the center, tapering to lesser depths along the edges, which is placed on areas contoured for final reclamation. When the area is seeded, the islands act as recruitment stations for the establishment of vegetation in areas with shallower depths of growth media.

3. Soil islands will generally be 15 feet by 15 feet in size, with depths of 8 to 12 inches, covering approximately 75 percent of the disturbed area. The remaining disturbed area will be covered

with the balance of the available growth media. The islands contribute to the undulating topography of the final contour and create small microhabitats, which in turn will enhance diversity on the site.

4. Growth media will be placed on prepared sites in early fall, prior to seeding in September or October. Growth media placement will be inspected periodically to ensure a sufficient depth of material is being placed. The surface of the area will be left in a rough or furrowed state to reduce wind and water erosion and to increase available soil moisture in the growth media layer.

1.5.7 SEEDBED PREPARATION

1. Microtopography is essential to successful seedbed preparation. "The small surface irregularities of seedbeds often determine the success of germination, growth, and survival of seedlings. These small-scale irregularities (no more than a few inches) trap moisture, and may stay moist longer because they are partially shaded and stay out of wind. Temperatures are modified because of various slopes and degree of protection offered. This variety of conditions increases the chances that somewhere on the site the environment is favorable for establishment and growth" (Van Kekerix and Kay, 1986).

2. Prior to planting, adequate site preparation will be essential to provide a suitable environment for seed germination and seedling establishment. Seedbeds will be firm below the seeding depth, but well pulverized and loose on top to enhance moisture infiltration and provide good seed to soil contact (Forest Service, 1979; Vallentine, 1971). Seedbeds will be as free of potential competitors as practicable.

3. Where disturbance has been light, such as around water well sites, and/or it is desirable to preserve native species that are indigenous, tillage will be avoided or minimized. In these cases drill or broadcast seeding may be possible without any seedbed preparation. Small areas of severe disturbance within a larger area that has been subject to light disturbance will be seeded by hand rather than increasing the level of disturbance and destroying residual populations of desirable species. In addition, nursery-grown plants will be transplanted in such circumstances.

4. On sites where growth media has been compacted by vehicular traffic or construction activities, where fill has been emplaced and packed, where native vegetation has been

destroyed, or where populations of undesirable species have become established, more extensive tillage will be conducted. Tillage will be divided into primary and secondary operations where needed. Where severe disturbance and compaction has occurred, primary tillage with an offset disk will be used to loosen the top nine inches and bury seeds that are near the soil surface. Secondary tillage with a cultipacker may be used to prepare the site for drilling.

5. Seedbed preparation will be conducted in a short time frame, to minimize the effects of wind and water erosion prior to establishment of vegetative cover.

1.5.8 SEEDING AND PLANTING SOURCES

1. Seeding and planting are vital parts of the reclamation process. Seeding and planting techniques will be dictated by the plant species to be grown, soil type and condition, and climate. Seeding depth, water catchments, and seeding rates are dependent on plant species. Field trials will be conducted during project operations to determine appropriate seeding and planting techniques for each species.

2. Local species have survived and dominated the site, because they are adapted for long term viability under the climatic conditions to which the site is subjected. Since local populations of native species are obviously well-adapted to the environmental conditions presented at the project site, local patches of undisturbed vegetation will serve as a guide for species selection.

3. There can be tremendous genetic variability among populations within a species. Such species typically consist of many local populations or ecotypes that are genetically adapted to the local environment. Sources of plant materials will be sought, such that the difference between the genetics of plants used for revegetation and that of the surrounding natural populations of the same species is minimized.

4. The best sources, therefore, may be seeds or transplant stock from the surrounding native areas. To maintain native plant species diversity and the integrity of the gene pools of those species, the Castle Mountain Project will use native species and local sources whenever possible.

5. Native species of seeds to be used onsite are listed in Table 1.2 (Seed List, Planting Methods and Uses). The composition of proposed seed mixes will be submitted to the BLM and County for approval. Seeding rate information similar to that shown in Table 1.3 (Seeding Rate Information) will be assembled for seed mixes under consideration for use at the project site.

6. Potential local suppliers of plant materials are listed below. Numerous other sources exist. Several of these companies are prepared to conduct seed collection onsite, and will propagate seedlings upon request. Collection areas and techniques will be established by Viceroy and the company doing the collection and propagation. Certification programs will verify that the genetic integrity of released varieties is maintained.

   - Granite Seed Company
     1697 West 2100 North
     Lehi, UT 84043
     Phone: (801) 768-4422
   - The Theodore Payne Foundation
     10459 Tuxford St.
     Sun Valley, CA 91352
     Phone: (818) 768-1802
   - Plummer Plant and Seed
     P.O. Box 70
     Ephraim, UT 84627
     Phone: (801) 283-4844
   - Desert Enterprises
     P.O. Box 23
     Morristown, AZ 85342
     Phone: (602) 388-2448
   - S&S Seeds
     P.O. Box 4093
     San Marcos, CA 92069
     Phone: (619) 744-3256

1.5.9 CHARACTERISTICS OF RECOMMENDED SPECIES

1. Characteristics of selected species will be evaluated in the experimental garden or in other revegetation areas. Performance will be rated from poor to excellent, based on growth and survival in the experimental garden and areas prepared for revegetation. The following perennial grasses, forbs, and shrubs are candidates for evaluation.

TABLE 1.2

SEED LIST, PLANTING METHODS AND USES

SPECIES LIST	COMMON NAME	METHOD	ORIGIN	USES
GRASSES				
Muhlenbergia porteri	Muhley	Cultipacker seeder, Drill	Native	1, 2
Hilaria jamesii	Galleta	Cultipacker seeder, Drill	Native	1, 2, 3, 4
Oryzopsis hymenoides	Indian rice-grass	Cultipacker seeder, Drill	Native	1, 2, 3, 4
Sporobolus cryptandrus	Sand dropseed	Cultipacker seeder, Drill	Native	1, 2, 3, 4
Bouteloua curtipendula	Sideoats grama	Cultipacker seeder, Drill	Native	1, 2, 3, 4
FORBS				
Sphaeralcea ambigua	Desert mallow	Cultipacker seeder, Drill	Native	1, 2, 3, 4
Cassia covesii	Desert senna	Cultipacker seeder, Drill	Native	1, 3
Penstemon stephensii	Steven's penstemon	Cultipacker seeder, Drill	Native	1, 4
Oenothera Californica	White evening primrose	Cultipacker seeder, Drill	Native	1, 2, 3
Baileya multiradiata	Desert marigold	Cultipacker seeder, Drill	Native	1, 2, 3, 4
SHRUBS				
Ephedra nevadensis	Mormon tea	Cultipacker seeder, Broadcast, Wildings, Containerized	Native	1, 2
Prunus Fasciculata	Desert almond	Cultipacker seeder, Broadcast, Wildings, Containerized	Native	1, 4
Atriplex canescens	Fourwing saltbush	Cultipacker seeder, Broadcast, Wildings, Containerized	Native	1
Larrea tridentata	Creosote bush	Cultipacker seeder, Broadcast, Wildings, Containerized	Native	1, 4
Coleogyne ramosissima	Blackbrush	Cultipacker seeder, Broadcast, Wildings, Containerized	Native	1, 2

88-148B (7/25/90)

Recommended uses are coded as follows:

1 = restoration of natural communities
2 = slope stabilization
3 = roadsides
4 = gullies

TABLE 1.3

SEEDING RATE INFORMATION

SPECIES	PERCENT OF MIX (BY SEED COUNT)	PLS SEEDS PER FT^2	BULK SEEDS PER LB.	ESTIMATED PLS %P. OF SPP.	PLS SEEDS PER LB.	PLS SEEDS PER ACRE	PLS LBS. PER ACRE
Muhlenbergia porteri	9.00	4.50	1,600,000	80.00	1,280,000	196,020	0.1512
Hilaria jamseii	9.00	4.50	169,000	55.00	92,950	196,020	2.24
Oryzopsis hymenoides	12.00	6.00	141,000	85.00	119,850	261,360	2.18
Sporobolus cryptandrus	10.00	5.00	5,298,000	85.00	4,503,300	217,800	0.05
Bouteloua curtipendula	8.00	4.00	191,000	78.00	148,980	174,240	1.17
Sphaeralcea ambigua	5.00	2.50	500,000	80.00	400,000	108,900	0.27
Cassia covesii	6.00	3.00	110,000	84.00	92,400	130,680	1.41
Penstemon stephensii	6.00	3.00	610,000	80.00	488,000	130,680	0.27
Oenothera California	4.00	2.00	512,000	85.00	435,200	87,120	0.20
Baileya multiradiata	6.00	3.00	1,060,000	78.00	826,800	130,680	0.16
Ephedra nevadensis	6.00	3.00	19,900	80.00	15,920	130,680	8.21
Prunus fasciculata	1.50	0.75	4,800	88.00	4,224	32,670	7.73
Atriplex canescens	10.00	5.00	52,000	55.00	28,600	217,800	7.62
Larrea tridentata	7.50	3.75	175,000	82.00	143,500	163,350	1.14
TOTAL	100.00	50.00				2,178,000	32.80

88-148B (7/24/90)

*Prepared by Granite Seed Company

1.5.9.1 Perennial Grasses

1. *Muhlenbergia porteri*, Muhley grass - Cool season, native perennial bunchgrass is widespread on dry rock slopes. It occurs in the protection of shrubs and subshrubs. It is highly palatable to livestock (Gould, 1968).

2. *Hilaria jamesii*, Galleta - Warm season, native perennial bunchgrass, a sod former which tolerates a broad range of climatic conditions; can survive where mean annual precipitation is 3.7 inches; root and rhizome system makes it a good soil binding species and therefore a valuable erosion control species; for grazing, erosion control, and wildlife plantings. This species has generally adapted to desert grassland and desert shrub communities; may be difficult to establish; low seed production; good seed germination, produces tough, woody rhizomes which is this species' surest means of reproduction; roots and rhizomes most abundant near the surface; long-lived; palatable and tolerant to grazing (Long, 1978).

3. *Oryzopsis hymenoides*, Indian ricegrass - Cool season, native perennial bunchgrass. Seeds may need proper scarification treatment before planting for best results (reports vary); can be used to revegetate droughty and/or sandy soils; should be used in mixtures only; seed and forage important to birds and big game; recommended for erosion control, grazing, and wildlife plantings in the desert and semi-desert climatic zones; erosion control on coarse textured soils at elevations from 3,000-7,000 feet where precipitation ranges from 8 to 16 inches; generally adapted to desert vegetation types (Long, 1979). Indian ricegrass may be difficult to establish; low germination rate; seeds may remain dormant for years; good growth rate; adapted to sandy and infertile soils; can survive on five to seven inches of precipitation per year; moderate palatability, moderately tolerant to close grazing; characteristic of dry, sandy soils (Long, 1979). Nearly all the species are highly palatable to stock but are not in sufficient abundance to be of importance, except *O. hymenoides*, which is common in arid and semiarid regions of the west and furnishes much feed (Hitchcock, 1971).

4. *Sporobolus cryptandrus*, Sand dropseed - Warm season, native perennial bunchgrass which is reported to be a good revegetation grass for drought tolerant and sand stabilization mixtures; not readily used as a pasture species unless other more palatable species are not adapted; not tolerant to heavy use; seed should be planted shallowly; important to ground-feeding birds; recommended for erosion control and wildlife plantings in desert and semi-desert climatic zones; for sand stabilization in the 8 to 10 inch zone in Nevada (Long, 1979). Establishment of sand dropseed is reported to vary from easy to difficult. Other characteristics include

moderate growth rate, good persistence, hard seed which germinates after specific treatment. This species invades disturbed areas readily. It is not shade tolerant. Plants are palatable in early growth stage, but not when mature (Long, 1979).

5. *Bouteloua curtipendula*, Sideoats grama - Warm season, native perennial bunchgrass, a sod former which has potential from revegetating road cuts, mined areas, construction cuts-and-fills; can tolerate low fertility; may be useful for controlling erosion; recommended for erosion control, grazing, and wildlife plantings in the desert and semi-desert (Long, 1979). Sideoats grama shows a fair ease of establishment; plants are highly nutritious, and found on a variety of sites including well-drained uplands and rocky areas. Species is a bunchgrass which forms a sod under heavy grazing (Long, 1979).

1.5.9.2 Forbs

1. *Sphaeralcea ambigua*, Desert globemallow - Drought tolerant; full sunlight; bright orange-red flowers blooming March to June along desert slopes and flats in the southwestern U.S. and Mexico; one of the largest flowered and drought tolerant globemallows (Granite Seed, 1989).

2. *Cassia covesii*, Desert senna - Drought tolerant; full sunlight; yellow flowers blooming April to October in sandy areas from New Mexico to California and south into northwestern Mexico (Granite Seed, 1989).

3. *Penstemon stephensii*, Stephens' Beardstongue - Listed by the FWS as probably appropriate for listing as an endangered or threatened species and by the California Native Plant Society as a special interest species; is a relatively short-lived forb that occurs in the blackbush shrub type and slightly acidic soils on disturbed and exposed sites. This species is sought out by big game and livestock during winter and spring months. Seed is available from a local distributor (Payne, 1990).

4. *Oenothera californica*, White evening primrose - Drought tolerant; full sunlight; white flowers blooming May to September from valleys to foothills, in dry open areas, gravelly or sandy soils; flowers open in late afternoon (Granite Seed, 1989).

5. *Baileya multiradiata*, Desert marigold - Drought tolerant; full sun; brilliant yellow flowers blooming intermittently from March to November; recommended for desert areas; native to the southwestern U.S. and northern Mexico (Granite Seed, 1989).

1.5.9.3 Shrubs

1. *Ephedra nevadensis,* Mormon tea - Native desert species that is more tolerant of soil salinity and drought. It has potential as a forage and in stabilizing valleys and drier sites. It is common on shallow to medium depth sandy or rocky slopes and in valleys of the salt, southern, and higher creosote bush deserts, desert grasslands, Joshua tree, etc. It tolerates calcareous, weakly saline and slightly saline-alkaline sites, and is sometimes in clay soils. It thrives in dry, well drained sites, usually on sites receiving 8 to 12 inches of precipitation. Fall seeding is recommended (Horton, 1989).

2. *Prunus fasciculata,* Desert almond - Native that occurs throughout the more arid pinion-juniper, big sagebrush, salt desert shrub, and blackbush communities. It frequently occupies dry stream banks and gullies where infrequent run-off occurs. It is an upright, deciduous shrub that provides important ground cover and wildlife habitat. It is not highly palatable to big game or livestock, but is important to upland gamebirds and small mammals. Fruits form rather large stones or seeds. Germination is often erratic, but small seedlings grow quite rapidly and persist well amid arid conditions. Like many other desert shrubs, this species has not been widely planted but is an important species that has not been replaced with another plant (Horton, 1989).

3. *Atriplex canescens,* Fourwing saltbush - A native upright shrub that grows in a wide variety of soil types from valley bottoms and plains to mountainous areas. It is well suited to deep, well-drained sandy soil, sand dunes, gravelly washes, mesas, ridges, and slopes, but vigorous plants are also found in heavy clays. It is frequently intermixed with numerous shrub and grass species. Fourwing saltbush is one of the most valuable forage shrubs in arid rangelands because of its abundance, accessibility, palatability, size, evergreen habit, nutritive value, rate of growth, and large volume of foliage. Its leaves, stems, and utricles provide browse in all seasons. It withstands extremely heavy browsing, and growth often appears to be stimulated by use. This species is one of the most important shrubs in the rehabilitation of depleted rangelands and in soil stabilization projects. It is established by direct seeding and by bare root and container transplanting. Seed can be covered to 3/8 inch depth. Seed sources should not be moved and seeded in colder climates, but can be moved and seeded in warmer climates (Horton, 1989). Fourwing saltbush is good for alkaline and saline soil revegetation, with a high value for range restoration and soil stabilization. It has been seeded on arid rangelands, has the ability to survive and grow satisfactorily in a broad range of environments in the Intermountain Regions, and has a short stratification period so it can be seeded with forbs. Seeds would be covered lightly (>1.5 inches) or broadcast planted. Fourwing

saltbush is grazed by wildlife and livestock in all seasons. Protection of establishing stands from wildlife and livestock is often necessary. Thick stands can be good for erosion control due to extensive and deep root systems (Long, 1979). Fourwing saltbush shows fair ease of establishment, fair germination rate, vigorous seedlings, and good growth rate. It averages three to six feet in height, has good persistence, average rate of natural spread, and good herbage yield. It has a wide range of adaptation, is tolerant to grazing, and continues growth throughout mid-summer. Seedlings are susceptible to frost damage, are highly palatable, but have a low tolerance to close grazing (Long, 1978). Increase in elevation within zones delays flower development (Blauer *et al.*, 1976).

4. *Larrea tridentata*, Creosote bush - Native woody evergreen, strong scented shrubs (Harrington, 1964). Widespread desert shrub in arid regions of the southwest.

5. *Coleogyne ramosissima*, Blackbush - Densely branched shrubs found on mesas and hillsides, in dry often rocky ground. Found from Colorado to California (Harrington, 1964).

1.5.10 SEEDING AND PLANTING METHODS

1. Seeding will be accomplished by cultipacker, drill, broadcast, or hydroseeding methods, depending upon the steepness of the slopes and whether secondary tillage is planned. Each method will be evaluated for effectiveness and overall cost.

2. Cultipackers equipped with seed boxes will be evaluated for use where secondary tillage is planned. Cultipackers will be equipped with several seed boxes that allow seeding different species in individual strips. Cultipackers are toothed rings or truck tires on a horizontal shaft. Cultipackers smooth and firm the seedbed in preparation for drill seeding (Brown and Hallman, 1984). The seed boxes are mounted between two cultipackers. The front cultipacker will smooth and pack the seedbed while creating small furrows. The seed is broadcast onto the ground from the seed boxes. The second cultipacker, which is offset, fills in the original furrows and creates new ones. This results in seeds being covered to various depths. Resulting vegetation will not grow in rows and will be more natural in appearance.

3. Rangeland drills will be evaluated for use on rough terrain. Rangeland drills have single-disk furrow openers followed by chain or pipe drags to cover the seeds. As a consequence, furrow depth and the degree to which seeds are covered are variable. A seed mixture of species including grasses, forbs, and shrubs will be used with the rangeland drill.

4. For test plots a hand seeder will be used. The implement is similar to a garden cultivator and consists of a seed hopper, a wheel that drives the seed metering mechanism, a furrow opener, a furrow closer, a smaller wheel packer, and two wooden handles. For seeding it is easily pushed and maneuvered by one person. This technique is obviously labor intensive, but for work on test plots it is more economical than using motorized equipment.

5. Two situations at the mine site will necessitate broadcast seeding: (1) a site may be too steep or rocky for tillage and drilling and (2) the size or other characteristics of a particular seed may preclude drilling. Broadcast seeding will be followed by treatment with a harrow or cultipacker to cover the seed, when possible.

6. Hydroseeders, which apply seed by means of a high pressure stream of water, will be evaluated for use on steep slopes. A mulch will be applied in the same operation or by the same machine after the seed is applied.

1.5.11 SEEDING AND PLANTING TIMEFRAME

1. As a general guideline, the most favorable time for planting is immediately prior to the longest period of conditions favorable for plant growth. In the Castle Mountains, the growing season typically begins in early April and extends into July or August, at which time soil moisture reserves are depleted. Because the growing season is preceded by winter months during which most plants are dormant or quiescent, planting can be done in the fall or late winter.

2. Seed will be drilled or broadcast in the late fall (mid October through November) or late winter (February, early March). Fall seeding will have several advantages. Since the soils will usually be dry, impacts of heavy equipment are minimized and the seedbed will remain in good condition for plant establishment. Seed will be in the ground when temperature and moisture conditions are optimal the following spring.

1.5.12 CONTROL OF WEED AND EXOTIC SPECIES

1. To the extent exotics in revegetated areas exceed the levels of these species on non-disturbed areas at the project site, steps will be taken to reduce their numbers.

2. Exotics and weed species onsite will be removed by hand to the extent practicable. As stated previously, growth media stockpiles and areas prepared for revegetation will be seeded and mulched as quickly as possible to prevent invasion by exotics and weeds. Methods to control undesirable species primarily will be through cultivation, although mechanical cultivation will be considered based on the extent of the problem.

1.5.13 FERTILIZATION

1. Fertilization of reclamation sites is a hotly debated issue. Since the use of fertilizers to establish and maintain a plant community does not provide an accurate reflection of how the community will fare unaided by man over the long-term, some believe that use of fertilizers is unwise. Plants that respond well to short-term changes in the soil may fail when the fertilizer is depleted. This failure could lead to a reduction in desirable species and an invasion by weedy pioneer species.

2. Fertilization is supported by those who believe that by assisting in the establishment of plants, some of the effects of mining are mitigated. Plants are then vigorous enough to cope with environmental stresses that will come when the effects of fertilization are gone.

3. A test program will be established at the Castle Mountain Project to develop site-specific information on the benefits/drawbacks of fertilization procedures as part of the Revegetation Research Program. Test plots will be analyzed to determine deficiencies of various nutrients, and physical and chemical properties of the soil. Analyses will include the following components:

   - Available phosphorous
   - Available potassium
   - Available nitrogen
   - Electrical conductivity
   - Organic water content
   - Cation exchange capacity
   - Particle size analysis
   - pH
   - Buffer pH
   - Textural classification
   - A series of trace elements

4. Fertilizers and soil amendments will be applied to test plots at rates indicated through soil analyses. Application rates and frequency of application will vary on different test plots. Unfertilized test plots will be used as a control.

5. Should the test plots indicate fertilizer applications would be beneficial, fertilizers would be applied to areas being revegetated using fertilizer spreaders, granular applicators, drill seeders, or a hydrofertilizer. Use of a drill seeder can bury dry fertilizer at a relatively precise depth, so that fertilizer is in place when plant roots reach it. Drill seeder use would be limited to relatively smooth areas. By mounting a granular applicator behind a tillage implement, like a disk harrow or chisel plow, fertilizer will be broadcast on rough, cloddy seedbeds. This allows the fertilizer to be covered by and incorporated into the soil. Fertilizer spreaders will be evaluated to broadcast fertilizers over areas that are too steep or too rocky for tillage and drilling. Hydrofertilization will be evaluated for use on steep slopes where drill and broadcast fertilization are impractical due to slope constraints.

1.5.14 IRRIGATION

1. Ground water quality at the project site is good for both drinking and agricultural purposes. Salinity problems are not expected when this water is used for irrigation to assist revegetation efforts on selected areas within the project site.

2. Water is the major limiting factor in the semi-arid desert and irrigation is expected to markedly improve the probability for reclamation success. Site productivity, diversity, and stability will be promoted through the use of irrigation. Irrigation provides plants with water they would not obtain naturally, and therefore the use of irrigation is controversial.

3. Irrigation should provide adequate amounts of water but should not cause undue run-off or erosion, nor should it waste water. Because water is a limited resource, irrigation will be used as efficiently as possible.

4. Techniques that allow the water to penetrate deeply into the soil are often desirable (Brown and Hallman, 1984). Since evaporation takes place at the soil surface, irrigation that is frequent and light, will result in excessive evaporative losses. If water is deep in the soil, only a small percentage evaporates. Deep moisture will last longer in the soil and will reduce the need for irrigation frequency (Brown and Hallman, 1984).

5. An overhead sprinkler system will be evaluated for use in the nursery to prevent root rot.

6. The Revegetation Research Program will determine if irrigation is necessary on the various sites prepared for reclamation and will define the method most appropriate for each location. The research program will also define the frequency and rate for irrigation onsite. A hardening protocol will be established to wean plants from irrigation.

7. Drip irrigation is an intensive irrigation system that waters individual plants or small clumps of plants. Small diameter tubes carry water to the selected sites. They are often used on moderate to steep slopes, where horizontal tubes with variously placed water outlets irrigate individual plants. Watering rates must be regulated to prevent run-off and erosion (Brown and Hallman, 1984).

8. A water truck will also be evaluated for efficiency and effectiveness in providing irrigation to reclamation areas. Transplants would be watered periodically using the water truck.

9. Water harvesting will also be evaluated in the research program. Water harvesting is catching or concentrating natural moisture to increase moisture in desired areas. The techniques range from using impervious material to chance subsequent run-off to placing snow fences to catch blowing snow (Brown and Hallman, 1984).

10. Small scale use of impervious materials has more applicability for revegetation on arid and semi-arid sites. Condensation traps made with polyfilm have been used to collect and concentrate moisture for individual plants, especially to help individual plants become established (Jensen and Hodder, 1979). The condensation traps catch soil moisture as it evaporates. The moisture condenses on the underside of a plastic sheet and then runs down the sheet to the base of a plant. Condensation traps increase available moisture for the plants, are relatively inexpensive and can be easily modified to handle containerized seedlings, shrubs, trees, or grasses (Brown and Hallman, 1984). The plastic film, which also inhibits weed growth, breaks down in approximately five years.

11. Heap Leach Piles, where the existing drip irrigation systems can be used, will be irrigated in accordance with methodologies developed in field trails during the Revegetation Research Program. By using irrigation, succession can be advanced and in certain circumstances, site productivity, diversity, and stability are promoted. Test plots will be established on samples of spent heap leach ore, to determine rates and frequency for irrigation.

1.5.15 MULCHING

1. Mulching places a protective layer of material on the soil surface to increase soil moisture, prevent erosion, moderate soil temperature, and increase seedling establishment. Seedlings are protected from drying winds and insulated from temperature extremes when they are below the top of the mulch layer (Van Kekerix and Kay, 1986). Protection from heat is particularly important. Soil moisture on semi-arid mine sites is a critical factor in seed germination and seedling establishment. By creating air spaces above the soil surface, mulches insulate the soil from solar heat. Lowered heat reduces evaporation from the soil. This keeps a high water content near the soil surface for a longer time and promotes seed germination and seedling survival (Gardner and Woolhiser, 1978).

2. Mulches will be evaluated in the research program for limited use onsite. Research will focus on the use of rock mulches and mulches made from unsalvageable plant material, in order to avoid the introduction of exotics.

1.6 RECLAMATION SCHEDULE

1. Development of the project is described in Chapter 2.0 in terms of stages, as that best demonstrates to the reader how the acreage disturbed is expected to change over time. It also enables the regulatory agencies to determine, at the beginning of each stage, the bond amount that will be needed to reclaim the disturbances at the end of that stage, assuming the project was terminated at that time.

2. Reclamation efforts will be implemented at the earliest practicable time. It should be noted however, that Viceroy has selected a compact arrangement for the project, to minimize the amount of land to be disturbed, while using existing topographic features to screen the operation from public view from much of Lanfair Valley. As a result, those lands that are disturbed will be subject to fairly intensive use, limiting the opportunities for complete reclamation of most areas during the first several years of operation.

3. Table 1.4 (Reclamation Stages and Chronological Relationships) shows the projected timing for the various reclamation stages.

TABLE 1.4

RECLAMATION STAGES AND CHRONOLOGICAL RELATIONSHIPS (Months)

STAGES	START	END
Stage 1(1)	0	7
Stage 2	7	19
Stage 3	19	31
Stage 4	31	43
Stage 5	43	Lesley Ann Pit completed
Stage 6	--	Oro Belle Pit completed
Stage 7	--	Jumbo Pit and protore stockpiles completed
Stage 8	--	Leaching activities completed
Stage 9	--	Last leach pad decommissioned
Stage 10(2)	--	Reclamation procedures completed

88-148B (7/26/90)

Notes:

(1) Stage 1 will start upon receipt of the BLM's Record of Decision respecting the Plan of Operations for the Castle Mountain Project, and the County's approval of the Mining/Reclamation Plan application.

(2) Stage 10 involves revegetation activities in areas from which buildings and equipment have been dismantled and removed following project decommissioning (see Section 1.8, Decommissioning of Facilities). Stage 10 will commence within six months after project decommissioning, and will end after the fifth growing season following the initial plantings on the areas involved in project decommissioning.

4. Once physical reclamation procedures (i.e., regrading, surface preparation, etc.) have been completed in an area, revegetation activities will commence for that area. Table 1.5 (Incremental Acreage Prepared for Revegetation By Stage) summarizes when ground preparation activities (grading, contouring, growth media placement, scarifying, etc.) are estimated to be completed in each area.

5. Mining is a dynamic process that needs to respond to changing economic conditions and other factors. As with any lengthy construction project, it will be necessary to have flexibility built into the Plan. It is not possible to anticipate in advance what modifications to the reclamation program may arise from adjustments to the mining schedule, information from the Revegetation Research Program, and other factors. Bearing this qualification in mind, reclamation activities currently scheduled for completion are discussed by stage below.

1.6.1 STAGE 1

1. Sites for the experimental garden and nursery will be evaluated and an appropriate location developed. In conjunction with the establishment of the experimental garden and nursery, the Revegetation Research Program will initiate various research activities.

2. Heavy equipment operators will be trained on reclamation procedures and other environmental and safety issues through an educational program, as part of their orientation training for the project. Performance reviews will be based, in part, on operator adherence to these procedures. The educational program will be updated as procedures or issues change.

3. Vegetation within areas of temporary disturbance (such as for well consturction) will be crushed instead of bulldozed to enhance recovery.

4. Selected plant specimens and seeds will be collected for the Revegetation Research Program. Specimens of plant species believed to be amenable to transplanting will be collected for nursery stock. Vegetation salvaging activities are expected to be completed during the first two weeks of Stage 1. Once vegetation removal is complete, seedbank material and growth media will be salvaged and stockpiled in designated locations.

5. Overburden material from the Lesley Ann Pit will be placed around the perimeter of previous clay quarrying activities in the South Clay Pit Reclamation Area. This material will form the bottom terrace of the multiple terrace design utilized to reclaim this area.

TABLE 1.5

INCREMENTAL ACREAGE PREPARED FOR REVEGETATION BY STAGE[1]

AREA PREPARED	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	STAGE 8	STAGE 9	STAGE 10	TOTAL
Lesley Ann Pit[2]	–	–	–	–	–	10	–	–	–	–	10
Oro Belle Pit[2]	–	–	–	–	–	–	6	–	–	–	6
South Clay Pit Reclamation Area	–	6	6	20	–	–	4	–	–	–	36
South Overburden Pile	–	5	25	30	30	30	30	100	50	–	300
Heap Leach Pads	–	–	–	–	–	100	100	–	130	–	330
Solution Storage	–	–	–	–	–	–	–	–	10	–	10
Crusher Area	–	–	–	–	–	–	–	10	–	–	10
Plant Area	–	–	–	–	–	–	–	–	4	–	4
Administration	–	–	–	–	–	–	–	–	1	–	1
Roads	–	–	–	–	–	–	–	–	30	–	30
Soil Storage	–	–	–	–	–	15	15	10	30	–	70
Stage Subtotal (acres)	–	11	31	50	30	155	155	120	255	0	807
Cumulative (acres)	–	11	42	92	122	277	432	552	807	807[3]	

88-148B (7/26/90)

(1) Physical preparation of disturbed sites will be completed by the end of each Stage for the estimated acreage shown for that Stage. Staged revegetation activities will commence on each area after ground preparation has been completed.

(2) Physical preparation in the Lesley Ann and Oro Belle pits would occur on the pit floors and along the haul roads within the pit boundaries.

(3) Stage 10 involves revegetation in areas from which buildings and equipment have been dismantled and removed following project decommissioning (see Section 1.8, Decommissioning of Facilities). Stage 10 will commence within six months after project decommissioning and will end after the fifth growing season following the initial plantings on the locations involved in project decommissioning.

6. Approximately 1,700 tons of clay will be stockpiled in the North Clay Pit for reclamation on the Lesley Ann Pit during Stage 6.

1.6.2 STAGE 2

1. Rock staining experiments with Permeon will be conducted on exposed and cleaned pit walls in the Lesley Ann Pit. These experiments will be used to refine application procedures.

2. Revegetation Research Program activities will continue along with salvage operations for vegetation, seedbank material, and growth media.

3. Portions of west-facing slopes on the South Clay Pit Reclamation Area and South Overburden Pile, approximately 11 acres, will be brought to final grade. These areas will be available to evaluate reclamation procedures for sloped areas on a trial basis.

1.6.3 STAGE 3

1. Rock staining will be completed on 40,000 square feet of upper pit walls in the Lesley Ann Pit.

2. Revegetation Research Program activities will continue along with salvage operations for vegetation, seedbank material, and growth media. Spent heap leach ore will be available to begin field trials to evaluate revegetation methodologies using this material as a substrate.

3. An additional six acres of west-facing slopes in the South Clay Pit Reclamation Area will be brought to final grade. By the end of this stage, revegetation efforts will have the benefit of more than 24 months of site-specific testing and evaluation.

4. Approximately 25 acres of the South Overburden Pile will be prepared for revegetation. Once preparation is complete, revegetation activities will commence. Growth media to create "soil islands," will be obtained from areas being cleared at the "toe" of the South Overburden Pile as the pile advances to the south.

1.6.4 STAGE 4

1. Rock staining with Permeon will be completed on an additional 40,000 square feet of upper pit walls in the Lesley Ann Pit.

2. Revegetation Research Program activities will continue along with salvage operations for vegetation, seedbank material, and growth media.

3. All slopes in the South Clay Pit Reclamation Area will be brought to final grade. With the exception of approximately four acres on a lower terrace, that will be needed for access from the Oro Belle Pit to the Primary Crusher, the terraces will be prepared for revegetation following the procedures discussed in this Plan. These procedures include the careful placement of overburden creating contours and undulations for drainage and to establish microhabitats that will support plant diversity and wildlife, placement of growth media and seedbank material, and the preparation of the seedbed. Once preparation is complete, seeding and planting with native species and transplants will commence on 20 acres in this area.

4. An additional 30 acres of the South Overburden Pile will be prepared and revegetation activities initiated. Growth media salvaged from areas to be covered by the advancing pile will be placed in soil islands before revegetation commences.

1.6.5 STAGE 5

1. One hundred thousand square feet of additional upper pit walls will be stained.

2. Revegetation Research Program activities will continue in Stage 5.

3. Vegetation, seedbank material, and growth media removal activities will shift to the Oro Belle Pit, being prepared for development, and to the second leach pad, which will be needed to accommodate ore from the Oro Belle Pit.

1.6.6 STAGE 6

1. Rock staining with Permeon will be completed on the remaining 100,000 square feet of upper pit walls in the Lesley Ann Pit. The pit floor and haul roads within the Lesley Ann Pit, consisting of about 10 acres, will be ripped and scarified to reduce compaction, growth media distributed, seedbeds will be prepared, and vegetation procedures implemented.

2. Approximately 1,700 tons of clay stockpiled in the North Clay Pit will be placed in the lowest-lying depression (the 3,800-foot level) of the Lesley Ann Pit to create a one-acre ephemeral pond for wildlife. The clay will slow the percolation of water through the substrate.

3. Revegetation Research Program activities will continue.

4. An estimated 30 acres in the South Overburden Pile will be prepared so that revegetation can be undertaken.

5. Decommissioning activities will be completed on the initial Heap Leach Pad in accordance with procedures described in Section 1.8.4. Approximately 100 acres of this area will be brought to final grade and revegetation activities initiated.

6. Growth media will be withdrawn from soil storage and placed on soil islands in the South Overburden Pile.

1.6.7 STAGE 7

1. Revegetation Research Program activities will evaluate effectiveness of revegetation methodologies developed through Stage 6.

2. The four acres on the lower terrace of the South Clay Pit Reclamation Area that had been used for access to the Primary Crusher from the Oro Belle Pit will be scarified to reduce compaction, brought to final grade with growth media, and revegetation activities will be initiated.

3. The pit floor and haul roads within the Oro Belle Pit will be ripped and scarified, growth media distributed, seedbeds will be prepared, and revegetation activities initiated on approximately six acres.

4. An estimated 30 acres in the South Overburden Pile will be prepared for revegetation.

5. Decommissioning activities will be completed on the second heap leach pad, using procedures described in Section 1.8.4. Approximately 100 acres of additional leach pad area will be recontoured and revegetation activities initiated.

6. Growth media will be withdrawn from soil storage to create soil islands on the South Overburden Pile and Oro Belle Pit areas.

1.6.8 STAGE 8

1. Monitoring of revegetation progress on sites previously planted. Remedial action undertaken where required.

2. An estimated 100 acres in the South Overburden Pile will be prepared, and revegetation initiated. Growth media will be withdrawn from soil storage to create soil islands.

3. Decommissioning activities will be completed in the Crusher Area, as described in Section 1.8.2. This area, approximately 10 acres, will be graded, recontoured, growth media will be placed, and revegetation activities initiated.

1.6.9 STAGE 9

1. Continued monitoring of revegetation progress.

2. Physical preparation, including retrieval of growth media from soil storage, will be completed and revegetation activities initiated on the remaining 50 acres of the South Overburden Pile.

3. Decommissioning activities will be completed on the final Heap Leach Pad, using procedures discussed in Section 1.8.4. Approximately 130 acres of this area will be recontoured and revegetation activities initiated. Other areas to be decommissioned will include the Solution Storage Tanks and Basins (10 acres), the Process Area (4 acres), the Administration Area (1 acre), water wells and roads (30 acres), and the balance of the Soil Storage Areas (30 acres).

1.6.10 STAGE 10

1. This stage, which will be a 5-year post-operations reclamation monitoring phase, will commence within six months after decommissioning the areas described above in accordance

with agency requirements and as discussed in Sections 1.8.3, 1.8.5, and 1.8.7, respectively. The stage will end following the fifth growing season after the planting of the last locations to be revegetated when the project is decommissioned.

1.6.11 TEMPORARY SUSPENSION OF OPERATIONS

1. Measures to be implemented in the event Viceroy decides to temporarily suspend operations (defined as a shutdown for up to 24 consecutive months during which both mining and processing activities have been halted) are discussed in this section. The objective of these measures would be to protect the environment and the public. Proper arrangements for handling process chemicals, management of process solutions, heap leach piles, and surface drainage would be of particular concern.

2. The most probable cause for a decision to temporarily suspend operations would be a large decline in the price of gold, but other factors, such as a shortage of process reagents, or other conditions of force majeure, could be responsible for this decision.

3. Security personnel would be in attendance on a continuous basis during the suspension, to safeguard the substantial investment in plant and equipment, and to restrict public access to the project site.

4. Solution in the leach piles would be allowed to drain into the tanks and the emergency solution storage pond. It would be treated with a strong oxidant, such as hydrogen peroxide, to destroy free cyanide in the solution. The detoxified solution would be used to rinse the pile in order to flush out residual cyanide. This procedure would be repeated several times to lower the cyanide content in the piles to levels stipulated by the RWQCB.

5. Chemicals used in the gold recovery circuit would be flushed into the solution storage tanks and detoxified as part of the solution detoxification program. Surplus chemicals would be sealed and stored in secured areas.

6. Interceptor ditches around the leach pads and process areas would remain functional. Since the overburden disposal area surfaces will be sloped to the interior at a grade ranging from 0.5 to 1.0 percent, surface water will flow away from, rather than over, the crest. Run-off from the catchment area surrounding the pits would collect on the floor of the pits.

1.7 MAINTENANCE AND MANAGEMENT OF RECLAIMED AREAS

1.7.1 FENCING AND PROTECTION FROM HERBIVORY

1. Perimeter fencing around the project site will remain after revegetation of the site to restrict access by cattle and wildlife to revegetated areas. This will allow newly planted materials to have an opportunity to become established before being exposed to stress factors caused by normal multiple use. Fencing will also restrict public access to the site.

2. New plants are often eaten by rodents and insects and methods of mechanical protection will be required when herbivory is a problem. Cages and other protective devices will be evaluated in the research program to prevent herbivory in newly revegetated areas. There are a number of materials commercially available for protective use with seedlings and small container stock. Some of these materials are photodegradable, which would eliminate the need to remove the protective screen as plants grow larger.

1.7.2 MONITORING AND MAINTENANCE

1. Viceroy and regulatory agencies including the BLM, State, and County, will meet at regular intervals, to review the Plan and to evaluate progress. BLM will convene the meetings, which will be held in Years 0, 1, 3, 5, 7, 9, 11, 13, and 15.

2. A report will be prepared each year through the life of the project to document both the successes and failures arising from the Revegetation Research Program and the nature and extent of reclamation activities at the project during the preceding year. This report will be prepared as part of the Mitigation Compliance Monitoring Program that will be implemented for the Castle Mountain Project. The report will become part of the public record on file with the BLM and County.

3. In addition to the inventories to be performed on the control plots as discussed in Section 1.4.1, vegetation inventories will be performed on reclaimed areas. These inventories will measure density, diversity and other biometric information of perennial species using 10 meter circular plots. Photo point transects will be established to measure visual aspect. Revegetation success on each reclaimed area will be monitored annually for the first two years after planting and at three-year intervals thereafter.

1.8 DECOMMISSIONING OF FACILITIES

1.8.1 MINE PITS AND OVERBURDEN PILES

1. Mine pits will be left intact for potential future mining use, given the presence of low grade mineralization in the pit walls. Ground preparation will consist of ripping the floor of the pits and the haul roads leading out of them to reduce compaction, and spreading growth media on these surfaces to assist revegetation. Salvaged plants will be transplanted primarily on the floor of the pit.

2. Clay material remaining from old clay mine workings will be placed on the bottom of the Lesley Ann Pit to create an ephemeral pond for wildlife and migrating birds.

3. The upper pit walls visible to travellers in Lanfair Valley will be stained to reduce color contrasts. This will require treating the east wall of the Lesley Ann Pit above the 4,440 foot elevation. The South Clay Pit Reclamation Area will block pit walls below that elevation from view from Lanfair Valley.

4. The south face of the South Overburden Pile will be constructed with an intermediate flat bench or setback, so that the two lifts, placed at a 1.5H:1V slope create a 2H:1V slope overall. This face will also be scalloped for visual effect. Overburden in the South Clay Pit Reclamation Area will be placed in a series of terraces, also with an overall slope not greater than 2H:1V.

5. Growth media will be distributed to form "soil islands" on the South Overburden Pile and the South Clay Pit Reclamation Area, as described in Section 1.5.6. As part of the final recontouring of these areas prior to revegetation, microcatchment basins will be created, so that the available rainfall will be concentrated in certain areas.

1.8.2 CRUSHING FACILITIES AND CONVEYING SYSTEMS

1. After protore stockpiled on the South Overburden Pile has been processed and a decision is made to shut down permanently, demobilization activities will start. Structures will be disassembled, equipment will be salvaged, and foundations will be broken up.

2. Structural steel and sheet metal siding, decking, and grates will be sold to a scrap metal dealer. Demolition debris that has no salvage value will be disposed of at an approved landfill for such items.

3. The foundation for the Primary Crusher is a large reinforced concrete arrangement set into the hillside. This foundation will be buried in place when decommissioning this site. Foundations for the other structures in the crushing and conveying system will be buried in place whenever practicable, or will be broken up and hauled to the basins at the heap leach site for burial.

1.8.3 SOLUTION TANKS, BASINS, AND PIPING

1. Rinse water or a neutralizing solution will be circulated through the solution storage tanks, piping and heap leach piles, until residual cyanide concentrations are reduced to levels acceptable to the RWQCB. Once that level has been achieved, solutions will be allowed to evaporate. Sludge that has accumulated in the bottom of the solution storage tanks and basins will be collected and sent to a licensed hazardous waste site for burial.

2. Solution storage tanks will be disassembled and sold for salvage or scrap value. Concrete ring foundations beneath the tanks will be buried in place when the basins are backfilled.

3. After the tanks have been removed, the liners in the basins will be freed from anchor trenches, folded in on themselves, and covered with broken concrete from building foundations, slabs, and water-well pads. These materials will then be covered with a minimum of 10 feet of fill materials, primarily overburden. Final grading of the surface, including application of "soil islands" of growth media, will reestablish approximate pre-mining contours, thus restoring pre-mining drainage patterns in this area.

1.8.4 HEAP LEACH PILES

1. Spent ore on the heap leach piles will be detoxified by circulating rinse water or a neutralizing solution through the heaps until the residual cyanide concentrations are reduced to levels stipulated in the RWQCB waste discharge permit. After check sampling has confirmed the piles have been detoxified, spent ore piles will be graded to assure long-term stability.

2. Stabilization of post-closure heap landforms will be achieved through regrading and slope reduction as discussed in Section 1.10.1. Given the final 2.5H:1V average slope configuration, spent ore on the heaps will be stable. Some mounding of the heap tops will be

done during regrading. This will serve a dual purpose: (1) small scale reduction of visual contrast with surrounding landforms, and (2) creation of microcatchment hollows and depressions to direct surface flows to selected sites for revegetation purposes.

3. Process solutions will be evaporated concurrently with heap rinsing and detoxification. Any excess solutions from the gold recovery circuits will be pumped into the tanks and treated in the same manner as heap leach solution.

4. Surplus reagents, including cyanide, remaining in sealed containers at the time of closure will be shipped back to the manufacturer via approved transport. Unsealed, partially-used reagent containers will be dealt with on an individual basis. Nonhazardous or nontoxic reagents will be hauled to the County-operated landfill at Barstow. Toxic and hazardous chemicals will be shipped to facilities licensed to accept them for permanent disposal.

1.8.5 PROCESSING/ADMINISTRATION STRUCTURES

1. Buildings and structures not needed for continued reclamation and monitoring will be dismantled and removed. Concrete footings, slabs, and foundations will be buried in place or in the basins near the Process Area.

1.8.6 OTHER FACILITIES

1. Prior to project termination, BLM will be asked to designate which well is desired for recreational needs, stock watering purposes, and wildlife guzzler supply. This would allow water supplies in northern Lanfair Valley to be improved without drilling new wells and disturbing additional land. Water wells not then currently needed for reclamation irrigation requirement for the Castle Mountain Project will be decommissioned at the end of the mine life in a manner that complies with the specifications of the County Department of Environmental Health Services and leaves the wells in a condition that will allow them to be reopened at such time as Viceroy's needs may determine.

2. A licensed California driller/contractor will be hired by Viceroy to perform the required work on wells to be decommissioned. Concrete platforms surrounding each well-head will be demolished and the broken concrete will be placed in the basins at the leach pad area or at

other areas acceptable to BLM. Casing removal and plugging will be performed by the driller/contractor. After these tasks have been completed, the well site areas (and related service roads) will be scarified to eliminate soil compaction, and revegetated.

3. Aboveground utilities will be removed. Underground lines will be capped and covered. All other equipment and materials will be removed from the site.

1.8.7 ROADS

1. Site roads, parking lots, and portions of access roads designated by BLM for closure will be reworked, scarified, and revegetated. Subject to BLM's authority to decide otherwise, Viceroy will reclaim segments B through I of the project access route (see Figure 4.4) as one of the last decommissioning acts.

2. Creosote bush scrub is the dominant vegetation community along most of Clark County Road A68p in Piute Valley. Clark County intends to initiate abandonment proceedings for this road. It is expected that these can be completed within two years of project approval. After these proceedings have been completed, Viceroy will initiate reclamation activities along this route. It is anticipated that the reclaimed alignment will be used for recreational horseback riding. Since the road is about three times (15-16 feet) the width needed for an equestrian trail, two-thirds of the width of the graded portion of the road will be ripped and scarified to reduce compaction, then seeded. Seed composition will be submitted to BLM for approval. Both terminus points of A68p will be bermed to deter vehicular access, and fenced. Signs will be posted advising that the alignment is a riding trail, closed to motorized vehicles, and giving directions to the new access road, so that drivers will be able to proceed to State Highway 164 (eastbound), or into Lanfair Valley (westbound), via the project access route.

1.9 NATURAL REVEGETATION AND EXISTING VEGETATION

1.9.1 REVEGETATION OF CLAY QUARRIES

1. It is known from observations in the vicinity of the clay quarries that revegetation of areas at Hart that have been disturbed by mining activities are capable, under suitable conditions, of revegetation. Aerial photographs were used to date surface disturbances resulting from overburden dumping at the clay quarries. While it is not known when overburden disposal ended, it is known that the sites were active in 1960. This means that the maximum period for vegetation recovery on these sites is less than 30 years.

2. Photographs of vegetation growth on the clay quarry overburden are shown in Figures 1.3 (Natural Revegetation on North Clay Pit Overburden) and 1.4 (Natural Revegetation on South Clay Pit Overburden). As these photographs indicate, revegetation recovery, although variable, has in some areas been very successful.

3. Perennial plant species represented are shown in Table 1.6 (Natural Recovery of Plant Perennial Species on Clay Quarry Overburden Piles). All of the plants growing on the clay pits are native to the immediate area. These overburden piles were constructed without regard to revegetation recovery and reclamation was not conducted (the quarries were mined prior to the adoption of FLPMA and SMARA). Moreover, clay soils are typically a poor substrate for vegetation. This relatively fast rate of vegetation recovery is attributed primarily to the sites' elevation and rainfall regime. However, it should be noted that clay quarry areas with compacted soils and/or continued disturbance showed little or no vegetation recovery.

4. The Draft EIS/EIR stated that natural revegetation that has occurred over the Hart townsite during the last 70 years provides evidence of vegetation recovery supporting a 30- to 60-year time frame. Natural vegetation recovery on the clay quarry overburden sites further supports this estimate. The project revegetation program would be designed to enhance recovery of a community that will provide a usable habitat for wildlife.

1.9.2 EXISTING VEGETATION

1. Biological resources surveys of the project site were completed in 1987 (Gould, 1987a,b) and supplemented with additional surveys in June, 1988 and 1989, for the project site and possible routes of travel between the project site and Searchlight (Romspert, 1988, 1989). The results were presented in the Draft EIS/EIR and Supplement. The reader is directed to those documents if further information is desired.

2. A comprehensive plant species list is provided in Table 1.7 (List of Plants in the Castle Mountain Area). Results of field studies, literature review, and consultation with experts and agencies on desert flora indicate that no Federal or State-listed threatened or endangered plant species are expected to exist in the vicinity of the Castle Mountain project site.

88-148B/RP REV.5/25/90

136391



PHOTO 1: Overview of plant community on top of relatively flat overburden.



PHOTO 2: Young Joshua trees *(Yucca brevifolia)* in overburden disturbance area. colored marker shows one foot increments. View northeast.

FIGURE 1.3

NATURAL REVEGETATION ON NORTH CLAY PIT OVERBURDEN

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

88-148B/RP REV.5/25/90

136391



PHOTO 1: Close-up of overburden slope. Large shrubs are creosote bush *(Larrea tridentata)*. View northwest.



PHOTO 2: Overview of plant community on south facing overburden slope. Active clay quarring area is at top. View north.

FIGURE 1.4

NATURAL REVEGETATION ON SOUTH CLAY PIT OVERBURDEN

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

TABLE 1.6

NATURAL RECOVERY OF PERENNIAL PLANT SPECIES ON CLAY QUARRY OVERBURDEN PILES

SPECIES ON DISTURBED GROUND 30 YEARS FOLLOWING DISTURBANCE	SPECIES ON ADJACENT UNDISTURBED AREAS
ASTERACEAE (Sunflower Family) *Brickellia desertorum* *Ericameria linearifolia* *Gutierrezia microcephala* *Stephanomeria pauciflora* *Xylorhiza tortifolia*	ASTERACEAE (Sunflower Family) *Brickellia desertorum* *Ericameria linearifolia* *Gutierrezia microcephala* *Stephanomeria pauciflora* *Viquiera parishii* *Xylorhiza tortifolia*
BRASSICACEAE (Mustard Family) *Lepidium fremontii*	BRASSICACEAE (Mustard Family) *Lepidium fremontii*
CACTACEAE (Cactus Family) *Opuntia erinacea erinacea*	CACTACEAE (Cactus Family) *Opuntia erinacea erinacea* *Opuntia acanthocarpa coloradensis*
CHENOPODIACEAE (Goosefoot Family) *Atriplex canescens*	CHENOPODIACEAE (Goosefoot Family) *Atriplex canescens*
FABACEAE (Pea Family) *Acacia greggii*	FABACEAE (Pea Family) *Acacia greggii*
LAMIACEAE (Mint Family) *Salazaria mexicana*	LAMIACEAE (Mint Family) *Salazaria mexicana* *Salvia dorrii dorrii*
POLYGONACEAE (Buckwheat Family) *Eriogonum fasciculatum polifoium* *Eriogonum inflatum inflatum*	POLYGONACEAE (Buckwheat Family) *Eriogonum fasciculatum polifoium* *Eriogonum inflatum inflatum*
ROSACEAE (Rose Family) *Coleogyne ramosissima*	ROSACEAE (Rose Family) *Coleogyne ramosissima* *Prunus fasciculatus fasciculatus*
ZYGOPHYLACEAE (Caltrop Family) *Larrea tridentata divaricata*	ZYGOPHYLACEAE (Caltrop Family) *Larrea tridentata divaricata*
AGAVACEAE (Agave Family) *Yucca brevifolia jaegeriana* *Yucca schidigera*	AGAVACEAE (Agave Family) *Yucca brevifolia jaegeriana* *Yucca schidigera*
POACEAE (Grass Family) *Hilaria jamesii* *Stipa speciosa*	POACEAE (Grass Family) *Hilaria jamesii* *Stipa speciosa* *Muhlenbergia porteri*
	SOLANACEAE (Nightshade Family) *Lycium cooperi*

88-148B (7/25/90)

TABLE 1.7

LIST OF PLANTS IN THE CASTLE MOUNTAIN AREA

ANGIOSPERMAE (DICOTYLEDONES)

ANACARDIACEAE - SUMAC FAMILY
- *Rhus trilobata anisophylla*

ASCLEPIDACEAE - MILKWEED FAMILY
- *Asclepias erosa*

APIACEAE - CARROT FAMILY
- *Cymopteris multinervatus*
- *Lomatium nevadense*

ASTERACEAE - SUNFLOWER FAMILY
- *Acamptopappus sphaerocephalus*
- *Ambrosia dumosa*
- *Ambrosia eriocentra*
- *Artemisia ludoviciana*
- *Baileya multiradiata*
- *Baileya pauciradiata*
- *Baileya pleniradiata*
- *Brickellia arguta arguta*
- *Brickellia californica californica*
- *Brickellia desertorum**
- *Brickellia oblongifolia linearifolia*
- *Chaenactis stevioides brachypappa*
- *Chrysothamnus paniculatus*
- *Chrysothamnus teretifolius*
- *Cirsium neomexicanum*
- *Dyssodia cooperi*
- *Ericameria (Haplopappus) cooperi cooperi*
- *Ericameria (Haplopappus) cuneata cuneata (cuneatus cuneatus)*
- *Ericameria (Haplopappus) laricifolia (laricifolius)**
- *Ericameria (Haplopappus) linearifolia (linearifolius)*
- *Encelia virginensis actoni*
- *Erigeron divergens*
- *Erigeron foliosus covillei*
- *Erigeron pumilus concinnoides*
- *Eriophyllum ambiguum*
- *Gutierrezia microcephala*
- *Gutierrezia sarathrae*
- *Hymenoclea salsola salsola*
- *Leucelene ericoides*
- *Machaeranthera canescens*
- *Machaeranthera canescens canescens*
- *Machaeranthera tephrodes*

*Plants not in flower, identification tentative

TABLE 1.7

LIST OF PLANTS IN THE CASTLE MOUNTAIN AREA (CONTINUED)

ASTERACEAE - SUNFLOWER FAMILY - (Continued)
- *Malacothrix coulteri*
- *Psilostrophe cooperi*
- *Senecio multilobatus*

- *Stephanomeria exigua exigua*
- *Stephanomeria parryi*
- *Stephanomeria pauciflora*
- *Stylocline micropoides*
- *Tetradymia stenolepis*
- *Viquiera parishii (deltoides parishii)*
- *Xylorhiza (Machaeranthera) tortifolia*

BIGNONIACEAE - BIGNONIA FAMILY
- *Chilopsis linearis arcuata*

BORAGINACEAE - BORAGE FAMILY
- *Amsinckia intermedia*
- *Amsinckia tesselata*
- *Cryptantha circumscissa*
- *Cryptantha nevadensis*
- *Cryptantha pterocarya*
- *Cryptantha tumulosa*
- *Pectocarya setosa*
- *Plagiobothrys arizonicus*

BRASSICACEAE - MUSTARD FAMILY
- *Arabis perennans*
- *Arabis pulchra*
- *Caulalnthus cooperi*
- *Descurainia pinnata*
- *Descurainia sophia*
- *Draba cuneata*
- *Lepidium fremontii*
- *Lepidium lasiocarpum*
- *Lesquerella palmeri*
- *Sisymbrium irio*
- *Stanleya pinnata pinnata*
- *Streptanthella longirostris*
- *Thysanocarpus curvipes*
- *Thelypodium lasiophyllum*

CACTACEAE - CACTUS FAMILY
- *Coryphanthya vivipara deserti*
- *Echinocactus polycephalus*
- *Echinocereus engelmannii chrysocentrus*
- *Ferocactus acanthodes lecontei*

*Plants not in flower, identification tentative

TABLE 1.7

LIST OF PLANTS IN THE CASTLE MOUNTAIN AREA (CONTINUED)

CACTACEAE - CACTUS FAMILY - (Continued)
- *Mammillaria tetrancistra*
- *Opuntia acanthocarpa coloradensis*
- *Opuntia basilaris basilaris*
- *Opuntia chlorotica*
- *Opuntia erinacea erinacea*
- *Opuntia erinacea ursina*
- *Opuntia stanleyi parishii*

CARYOPHYLLACEAE - PINK FAMILY
- *Arenaria macradenia*

CHENOPODIACEAE - GOOSEFOOT FAMILY
- *Atriplex canescens*
- *Ceratoides (Eurotia) lanata*
- *Chenopodium incanum occidentale*
- *Grayia spinosa*
- *Salsola iberica*

CUCURBITACEAE - GOURD FAMILY
- *Cucurbita palmata*

EUPHORBIACEAE - SPURGE FAMILY
- *Chamaesyce albomarginata*
- *Euphorbia incisa*

FABACEAE - PEA FAMILY
- *Acacia greggii*
- *Astragalus lentiginosus fremontii*
- *Astragalus nuttallianus*
- *Lotus humistratus*
- *Lupinus brevicaulis*
- *Lupinus concinnus*
- *Hoffmanseggia glauca (densiflora)*

GERANIACEAE - GERANIUM FAMILY
- *Erodium cicutarium*

HYDROPHYLLACEAE - WATERLEAF FAMILY
- *Eucrypta micrantha*
- *Phacelia distans*
- *Phacelia fremontii*
- *Placelia crenulata crenulata*
- *Phacelia vallis-mortae**

KRAMERIACEAE - KRAMERIA FAMILY
- *Krameria parvifolia imparata*

*Plants not in flower, identification tentative

TABLE 1.7

LIST OF PLANTS IN THE CASTLE MOUNTAIN AREA (CONTINUED)

LAMIACEAE - MINT FAMILY
- *Marrubium vulgare*
- *Salazaria mexicana*
- *Salvia columbariae columbariae*
- *Salvia dorrii dorrii*
- *Salvia mohavensis*

LINACEAE - FLAX FAMILY
- *Linum lewisii*
- *Linum puberulum*

LOASACEAE - LOASA FAMILY
- *Mentzelia albicaulis*

MALVACEAE - MALLOW FAMILY
- *Sphaeralcea ambigua ambigua*

NYCTAGINACEAE - FOUR O'CLOCK FAMILY
- *Allionia incarnata*
- *Mirabilis bigelovii*
- *Mirabilis (Oxybaphus) coccineus*
- *Mirabilis multiflora pubescens (froebelii)*

OLEACEAE - OLIVE FAMILY
- *Menodora scabra*
- *Menodora spinescens*

ONAGRACEAE - EVENING PRIMROSE FAMILY
- *Gaura coccinea*
- *Oenothera californica californica*
- *Oenothera primiveris**

PAPAVERACEAE - POPPY FAMILY
- *Eschscholzia mexicana*

PLANTAGINACEAE - PLANTAIN FAMILY
- *Plantago purshii*

POLEMONIACEAE - PHLOX FAMILY
- *Eriastrum diffusum*
- *Eriastrum wilcoxii*
- *Gilia aliquanta*
- *Linanthus demissum*
- *Linanthus dichotomus*

POLYGONACEAE - BUCKWHEAT FAMILY
- *Centrostegia (Chorizanthe) thurberi*

*Plants not in flower, identification tentative

TABLE 1.7

LIST OF PLANTS IN THE CASTLE MOUNTAIN AREA (CONTINUED)

POLYGONACEAE - BUCKWHEAT FAMILY - (Continued)
- *Eriogonum deflexum deflexum*
- *Eriogonum fasciculatum polifoium*
- *Eriogonum heermanii floccosum*
- *Eriogonum inflatum inflatum*
- *Eriogonum maculatum*
- *Eriogonum nidularium*
- *Eriogonum palmerianum*
- *Eriogonum pusillum*
- *Eriogonum trichopes*
- *Eriogonum wrightii*
- *Rumex hymenosepalus*

RANUNCULACEAE - BUTTERCUP FAMILY
- *Delphinium parishii*

ROSACEAE - ROSE FAMILY
- *Coleogyne ramosissima*
- *Fallugia paradoxa*
- *Prunus fasciculatus fasciculatus*
- *Purshia glandulosa*

SCROPHYLARIACEAE - FIGWORT FAMILY
- *Castilleja chromosa*
- *Castilleja linearifolia*
- *Penstemon palemri*
- *Penstemon stephensii**

SOLALNACEAE - NIGHTSHADE FAMILY
- *Lycium andersonii*
- *Lycium cooperi*
- *Physalis hederaefolia*

VERBENACEAE - VERVAIN FAMILY
- *Aloysia (Lippia) wrightii*

ZYGOPHYLLACEAE - CALTROP FAMILY
- *Larrea tridentata divaricata*

ANGIOSPERMAE (MONOCOTYLEDONES)

AGAVACEAE - AGAVE FAMILY
- *Yucca baccata*
- *Yucca brevifolia jaegeriana*
- *Yucca schidigera*

*Plants not in flower, identification tentative

TABLE 1.7

LIST OF PLANTS IN THE CASTLE MOUNTAIN AREA (CONTINUED)

ALLIACEAE (AMARYLLIDACEAE) - AMARYLLIS FAMILY
Dichelostemma pulchella

LILIACEAE - LILY FAMILY
Calochortus kennedyi

POACEAE - GRASS FAMILY
Aristida purpurea
*Bouteloua sp.**
Bromus rubens
Bromus tectorum
Erioneuron pulchellum
Festuca octoflora
Hilaria jamesii
Muhlenbergia porteri
Oryzopsis hymenoides
Sitanion hystrix hystrix
Stipa speciosa

GYMNOSPERMAE

CUPRESSACEAE - CYPRESS FAMILY
Juniperus osteosperma

PINACEAE - PINE FAMILY
Pinus Monophylla

EPHEDRACEAE - EPHEDRA FAMILY
Ephedra nevadensis
Ephedra veridis

*Plants not in flower, identification tentative

1.9.2.1 Regional Vegetation

1. Vegetation in Lanfair Valley, as represented on the site, includes four plant communities: (1) creosote bush scrub, (2) Joshua tree woodland, (3) blackbush scrub, and (4) pinyon-juniper woodland. The plant communities below are described as they occur in this region of the Mojave Desert, including the Ivanpah, Piute, and Lanfair Valleys.

2. The creosote bush scrub community occurs on the valley floor and lower slopes of alluvial fans, generally below elevations of about 4,000 feet. Common species of this community include the creosote bush (*Larrea tridentata*), Mojave yucca (*Yucca schidigera*), burrobush (*Ambrosia dumosa*), mormon tea (*Ephedra nevadensis*), and fiddleneck (*Amsinckia intermedia*). Desert washes in this community support additional floristic components, the most common being the desert almond (*Prunus fasciculatus*) and catclaw acacia (*Acacia greggii*).

3. Joshua tree woodland occurs on gentle slopes with sandy or gravelly soils, at elevations between about 3,700 and 4,400 feet in northern Lanfair Valley. The most visible plant in this community is the Joshua tree (*Yucca brevifolia jaegeriana*), which is a member of the agave family. This conspicuous species is, in many people's minds, the most characteristic species of the Mojave Desert (MacMahon, 1988). The trees can reach heights of 10 to 30 feet and are scattered, with shrubs and herbs between. Other common species in this community include matchweed (*Gutierrezia microcephala*), cheesebush (*Hymenoclea salsola*), staghorn cholla (*Opunita acanthocarpa*), and the Mojave yucca (*Yucca schidigera*). Average densities of Joshua trees and Mojave yuccas in this area are estimated at four or more plants per acre for each species. The densities of both species decrease sharply on steeper slopes and at higher elevations.

4. The blackbush scrub community is dominated by blackbush (*Coleogyne ramosissima*). This plant community overlaps the Joshua tree woodland and occurs at elevations above about 4,200 feet on gentle slopes of the upper alluvial fans. Other common species include matchweed (*Gutierrezia microcephala*) and desert trumpet (*Eriogonum inflatum*). Also common in this community are several species of the cactaceae family, including the pancake prickly pear (*Opuntia chlorotica*), buckhorn cholla (*Opuntia acanthocarpa coloradensis*), and the barrel cactus (*Ferocactus acanthodes lecontei*).

5. Isolated areas of the pinion-juniper woodland community occur on hills in northern Lanfair Valley (such as near Barnwell) where elevations reach about 5,200 feet. This community, which also occurs in small pockets in the vicinity of Hart Peak and the Castle Peaks, becomes extensive in the higher New York Mountains. Common species include the single-needle pinion pine (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*), with shrubs between.

6. Most of the floor of Lanfair Valley is covered by an understory of grasses. These grasses typically occur on well drained soils within the Joshua tree woodland community. The species composition varies in response to local variation in soil nutrients and moisture. Additionally, grazing is an important factor in determining the floristic composition of grasslands. The project study area and Lanfair Valley are presently being grazed and have been for decades. Natives showing the highest densities are big galleta (*Hilaria rigida*), fluff grass (*Erioneuron pulchellum*), muhlenbergia (*Muhlenbergia porteri*), and grama grass (*Bouteloua* spp.). Desert grassland is classified as one of 13 unusual plant assemblages (UPAs) within the EMNSA (BLM, 1980).

7. UPAs were designated in the Desert Plan as unusual based on one or more conditions, including restricted habitat, discontinuous distribution, age, size, or density. Each UPA is assigned a sensitivity rating which is based on its ability to recover from habitat disturbance. The scale of sensitivity ranges from "highly sensitive" to "very sensitive" to "sensitive" to "subject to disturbance but not as sensitive." The Lanfair Valley desert grassland UPA is classified as "subject to disturbance, but not sensitive" (BLM, 1988a). This designation reflects the grassland's ability to recover following disturbance. Desert grassland UPA covers about 200,000 acres of Federal, State, and privately-owned lands in Lanfair Valley.

8. A riparian (or water-related) plant assemblage occurs at Piute Spring, located at the southeastern limit of Lanfair Valley. This riparian woodland is similar to the Colorado River bottomland woodland which occurs on the lower Colorado River along the California-Arizona border. The overstory is dominated by willow (*Salix gooddingii*) and cottonwood (*Populus fremontii*). Common understory species include narrowleaf willow (*Salix exigua*), mule fat (*Baccharis glutinosa*), and California bullrush (*Scripus californicus*). Riparian areas are classified by the Desert Plan as highly sensitive UPAs. The Piute Creek area is such a UPA.

1.9.2.2 Project Site Vegetation

1. A map depicting the distribution of plant communities at the project site is shown in Figure 1.5 (Plant Communities). Plant communities along the access roads are not shown, but are represented by the Joshua tree woodland and creosote bush scrub communities, as discussed below. The floral composition of the communities represented is typical of Lanfair Valley and the Mojave Desert, as described above. Perennial plant cover is commonly about 10 to 15 percent.

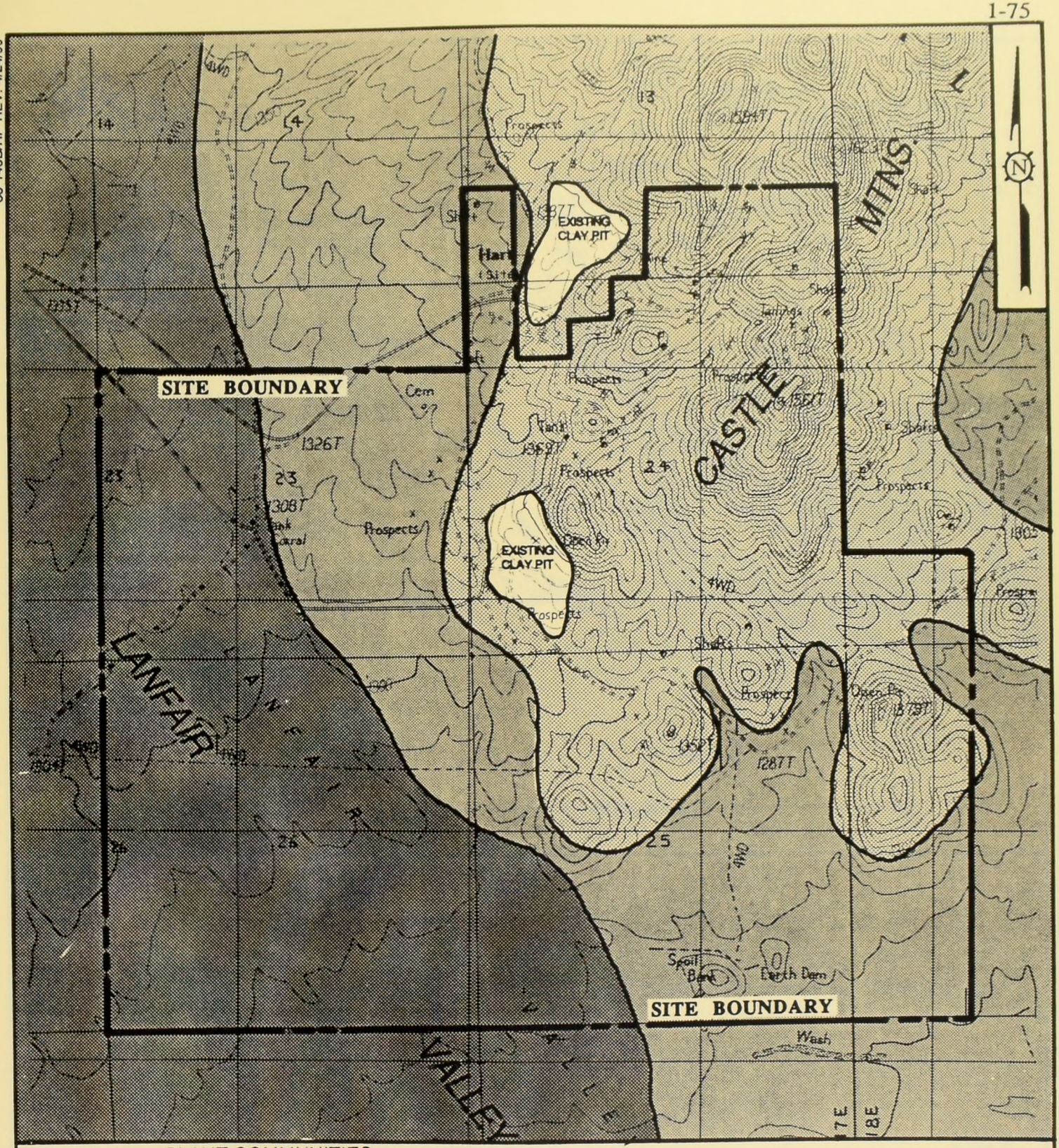
2. The project site lies at an elevation generally between 4,200 and 5,100 feet. The West Well Field is also located within this elevation range. The project access route follows the alluvial floor of Lanfair Valley north from the site to a maximum elevation of about 4,600 feet, then drops to an elevation of about 3,900 feet in Piute Valley. The two dominant plant communities which overlap the project site are Joshua tree woodland and blackbush scrub. Elements of the creosote bush scrub community overlap the Joshua tree woodland at lower elevations, such as in the area of the West Well Field and along portions of the access route.

3. About 1,000 acres of the 200,000-acre Lanfair Valley desert grassland UPA occurs over the lower portion of the project site. This grassland is characterized by the presence of numerous species of perennial grasses found in Lanfair Valley.

1.9.2.3 Special Interest Species

1. There are no listed or proposed endangered or threatened species known nor expected to occur on or in the vicinity of the project site. However, the Category 2 "candidate" species Stephens' Beardtongue (*Penstemon stephensii*) has been found in the area, having seeded itself in ground disturbed by road building activities, as shown in Figure 1.6 (Stephens' Beardtongue Location). *P. stephensii* generally occurs in the blackbush scrub community, on rocky slopes at elevations between 5,000 and 6,000 feet and often is found on sites where soil disturbance has occurred. During onsite inventories, Gould (1987b) also observed two "non-candidate" species, Category 3c white forget-me-not (*Cryptantha tumulosa*) and wild buckwheat (*Eriogonum heermannii floccosum*), at upper elevations.

88-148B/RP REV. 4/24/90



PLANT COMMUNITIES

COMMUNITY/HABITAT	ACRES WITHIN PROJECT BOUNDARY
DESERT GRASSLAND/ CREOSOTE BUSH SCRUB/ JOSHUA TREE WOODLAND	985
JOSHUA TREE WOODLAND	650
BLACKBUSH SCRUB	1,060
UNVEGETATED CLAY PITS	40
	TOTAL 2,735

CONTOUR INTERVAL: 10 METERS

REFERENCE: 7.5 MIN. U.S.G.S. TOPOGRAPHIC MAPS OF HART PEAK, CALIF. - NEV., AND CASTLE PEAKS, CALIF. DATED: 1984

0 .5 1 MILE

SCALE

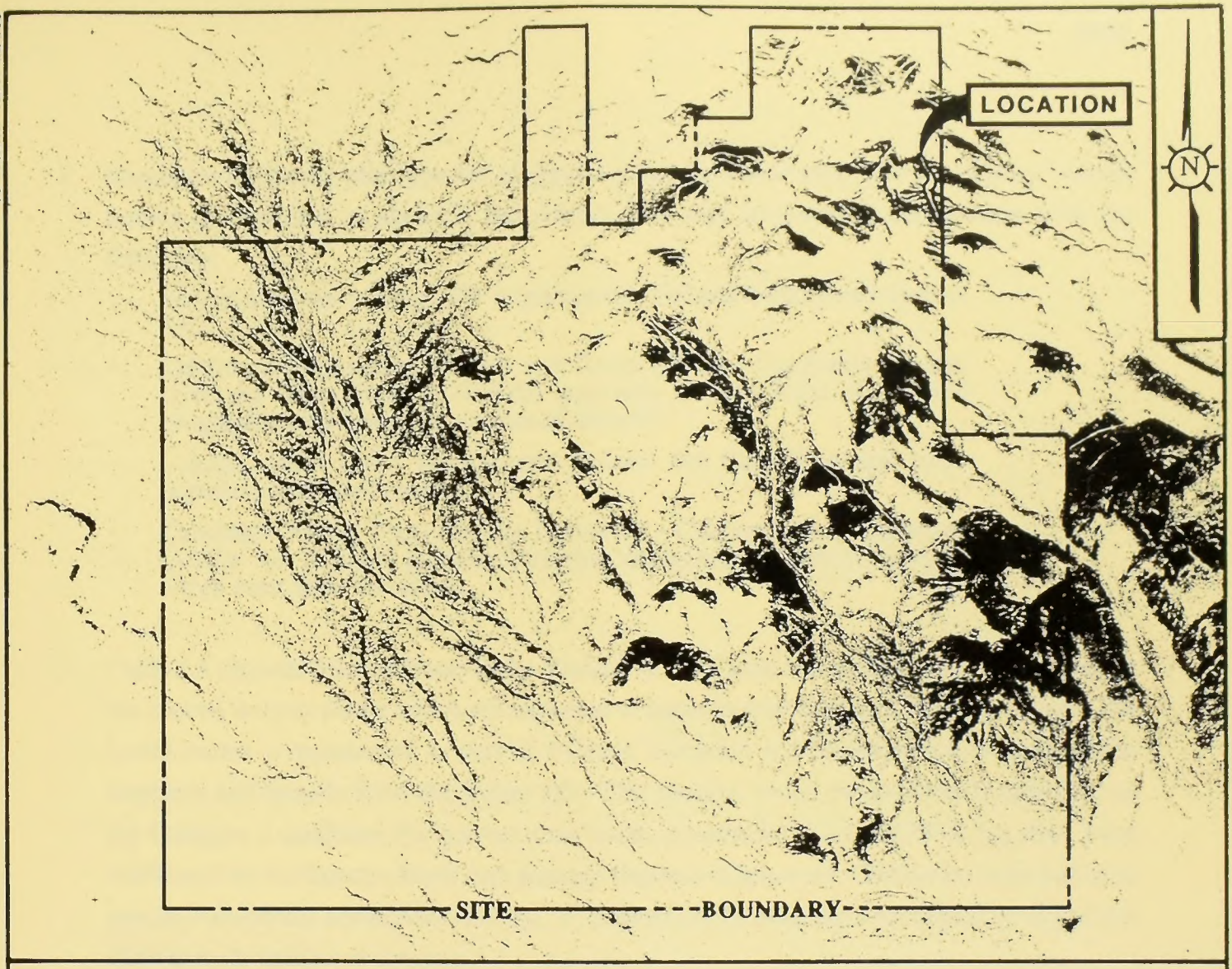
FIGURE 1.5

PLANT COMMUNITIES

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

88-148B/RP REV. 4/24/90



LEGEND

LOCATION OF STEPHENS' BEARDTOUNGE*(Penstemon stephensii)* POPULATION

0 .5 1 MILE

SCALE

FIGURE 1.6

STEPHENS' BEARDTONGUE LOCATION

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

2. Databases indicating plant species of special interest are available. The list of plant species known or expected to occur in the project area was reviewed in conjunction with the following:
   - Federal Register Listing - FWS (pursuant to Federal Endangered Species Act).
   - California Department of Fish and Game (DFG) - California Natural Diversity Data Base (CNDDB) provides current legal status and geographic coordinates for species of concern.
   - U.S.D.I. BLM List - Incorporates Federal and State lists, and some organizational listed species.
   - California Native Plant Society Inventory - California Environmental Quality Act (CEQA) guidelines support organizational lists for species which meet State list criteria.

3. Table 1.8 (Special Interest Plants in the Vicinity of the Castle Mountain Project Site) indicates the special interest plants which are expected to occur in the vicinity of the project site. The barrel cactus is represented as part of a Castle Mountain population which extends offsite northerly and easterly from the project site. This species, which was previously identified as the Category 2 candidate *Ferocactus acanthodes acanthodes* (Gould 1987a) has since been confirmed by the Rancho Santa Ana Botanic Gardens (Claremont, California) to be a related species *Ferocactus acanthodes lecontei. F. acanthodes lecontei* does not appear on any of the databases for species of concern.

4. During the scoping process, concern was raised that some additional special interest plant species may occur in the site area. Literature studies and onsite investigations do not indicate the presence of these species which include:
   - Viviparous foxtail cactus (*Coryphantha vivipara rosea*) and Clark Mountain agave (*Agave utahensis nevadensia*). These do not occur on the site, presumably because they are normally restricted to areas with limestone substrate. These plants are Federally recognized as Category C3c (non-candidate) species, and have been removed from BLM's "sensitive" species list.
   - Thorne's wild buckwheat (*Eriogonum ericifolium thornei*) is a Category 2 candidate that occurs in the New York Mountains only and is not expected in the Castle Mountains.
   - Bicolored penstemon (*Penstemon bicolor roseus*) is indicated as a special interest species in Nevada, but not in California. It is not known or expected to occur on the project site.

TABLE 1.8

SPECIAL INTEREST PLANTS IN THE VICINITY OF THE CASTLE MOUNTAIN PROJECT SITE

PLANT	FWS	DFG	BLM	CNPS
Cryptantha tumulosa	C3c	N/R	N/R	4
Eriogonum heermannii var. floccosum	C3c	N/R	N/R	4
Penstemon stephensii	C2	N/R	S	1B

88-148B (8/6/90)

LEGEND:

FWS (U.S.D.I. Fish and Wildlife Service)
Candidate Species:
C1 -Present information supports listing as an endangered or threatened species.
C2 -Present information suggests probable appropriateness for listing as an endangered or threatened species.
Non-Candidate Species:
C3a - Extinct
C3b - Taxinomically invalid
C3c - Too widespread and/or not threatened. No longer considered as a Federal candidate for listing.

"The taxa in Categories 1 and 2 are candidates for possible addition to the List of Endangered and Threatened Plants. The Service encourages their consideration in environmental planning,..." (FWS, 1985).

DFG (State of California Department of Fish and Game)
X - Plants listed on the California Natural Diversity Data Base (CNDDB).

BLM (U.S.D.I. Bureau of Land Management)
S - Considered "sensitive" by BLM, includes sensitive plants within the California Desert Conservation Area.

CNPS (California Native Plant Society)
1A: Plants presumed extinct in California.
1B: Plants rare, threatened, or endangered in California and elsewhere.
2: Plants rare, threatened, or endangered in California but more common elsewhere.
3: Plants about which we need more information - a review list.
4: Plants of limited distribution - a watch list.

N/R - Not recognized on current database.

TABLE 1.8

SPECIAL INTEREST PLANTS IN THE VICINITY OF THE CASTLE MOUNTAIN PROJECT SITE (Continued)

Legal differences exist between "listed" "endangered" and "threatened" species, "proposed" endangered and threatened species and "Candidate" species under the provisions of the Endangered Species Act and its implementing regulations. These terms and their meanings are summarized below:

Term	Interpretation
Endangered species	A species that is in danger of extinction throughout all or a significant portion of its range.
Threatened species	A species likely to become endangered in the foreseeable future throughout all or a significant portion of its range.

The following categories are used in conjunction with the above terms and the protection afforded plants:

Term	Interpretation	Protection Afforded Plants Under ESA
"Listed" (endangered or threatened species)	A species that has been the subject of a proposed and final rule or regulation in the Federal Register.	Fully protected. Recovery plans are required.
"Proposed" (endangered or threatened species)	A species for which a proposed regulation has been published in the Federal Register, but not a final rule.	Limited protection. Must be addressed in environmental assessments. Must confer with FWS if likely to jeopardize the continued existence.
"Candidate" (C1 and C2) species	Species being considered for listing as an endangered or threatened species but not yet the subject of a proposed rule.	Not protected. Should be monitored for impacts.*
"Non-Candidate" (C3) species	Species previously considered and included on past lists but now excluded because they are known to be extinct (3a), they are taxinomically unvalid or not meeting the FWS definition of a "species" (3b) or are too widespread or not threatened at this time (3c).	Not protected.

* BLM policy is to take positive action to prevent the need for Candidate (C1, C2) species to be listed.

1.10 POST-MINING TOPOGRAPHY AND PUBLIC SAFETY

1.10.1 TOPOGRAPHY

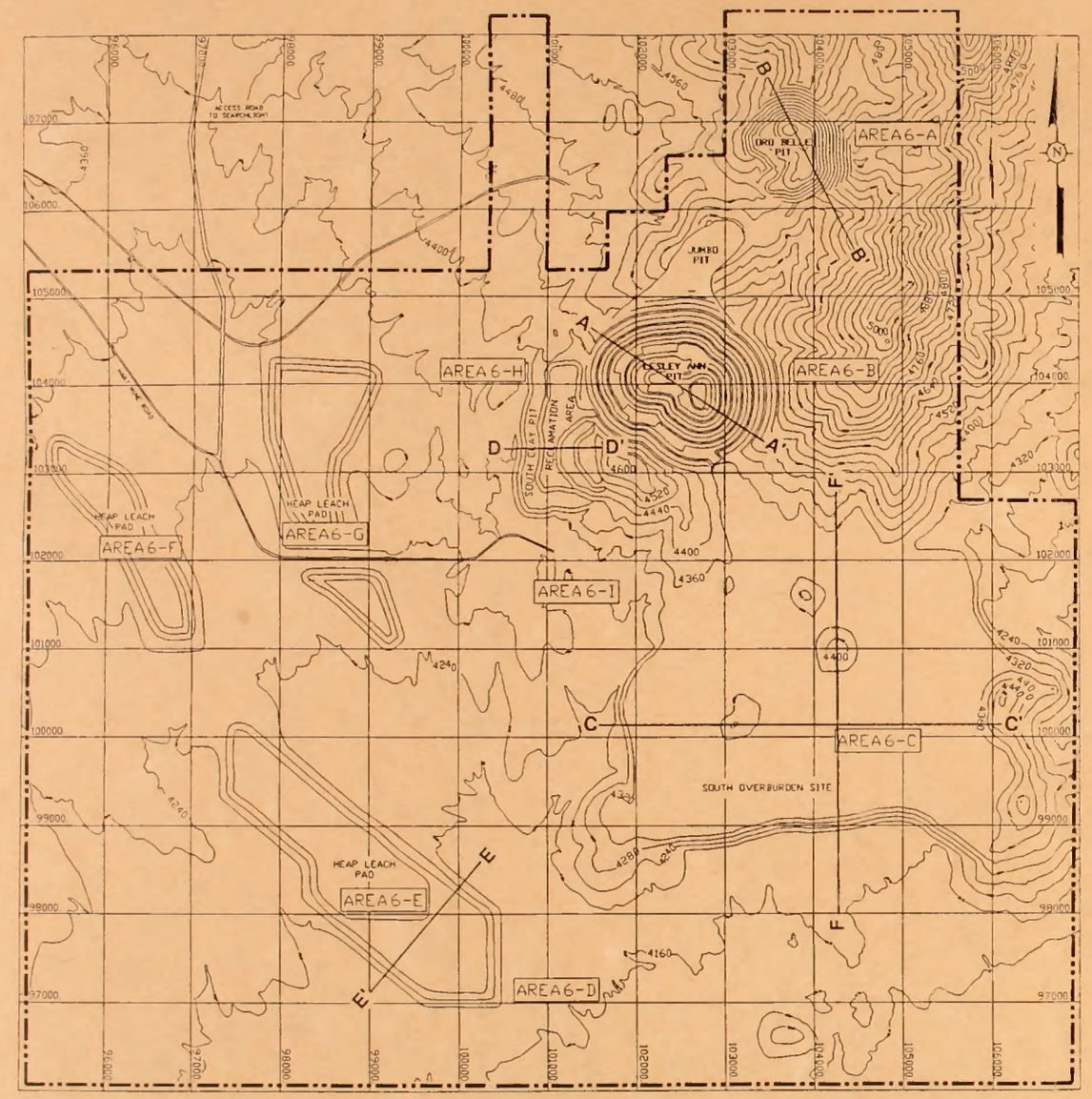
1. A plan map of post-mining topography for the project site is given in Figure 1.7 (Post-Mining Topography and Cross Sections). The major permanent changes to the topography at the site will be the excavated areas where the open pits are located (approximately 135 acres), and areas where the materials excavated from the pits will be deposited:
   - Heap Leach Pad Areas (330 acres)
   - South Overburden Site (300 acres)
   - South Clay Pit Reclamation Area (36 acres)

2. Decommissioning of heap leach facilities, overburden disposal areas, and process areas is discussed in the Closure Plan submitted to the RWQCB. A detailed analysis of the stability of earthen structures (the Heap Leach and Overburden Piles) was undertaken as part of the documentation submitted to the RWQCB in support of the waste discharge permit application. The long term stability of these structures will be assured through a regrading and slope reduction program on the faces of these piles, in accordance with engineering calculations and procedures approved by the RWQCB.

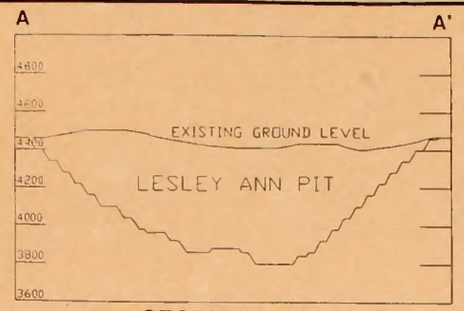
3. As constructed, the sides of active Heap Leach Piles will have slopes of 1.5H:1V on individual lifts, with as many as four 20-foot lifts with appropriate setbacks on benches between lifts to produce an overall 2H:1V slope face. After "spent" (i.e., leached) Heap Leach Piles have been detoxified, the sides will be flattened to an average 2.5H:1V slope with earthmoving equipment. As a result of the flattening, the toe of the heaps will move outward to cover the synthetic liner that encircled the heaps during active operations.

4. Slope stability studies by Steffen Robertson and Kirsten (consulting geotechnical engineers) determined that the proposed slope of 2.5H:1V is stable. Further reducing the slope angle to 3H:1V would moderately increase the side slope acreage, but implementing this slope angle would push material into the 100-year flood plain on the southwest corner. In addition, on the west and south sides, flattening slopes beyond that needed for stability would increase the area of disturbance.

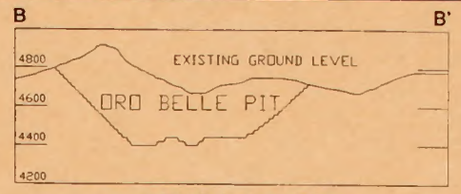
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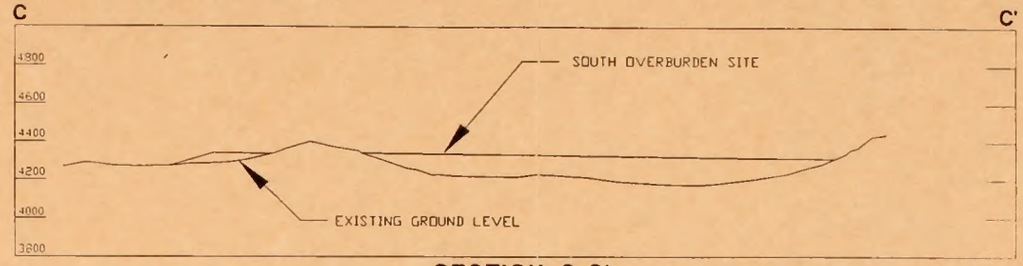
SITE PLAN



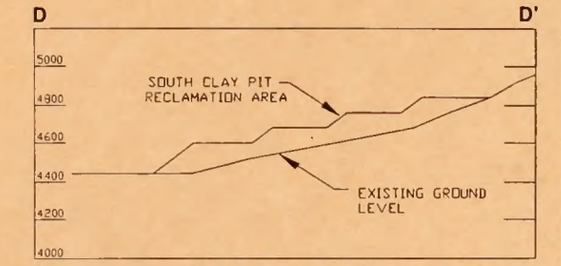
SECTION A-A'



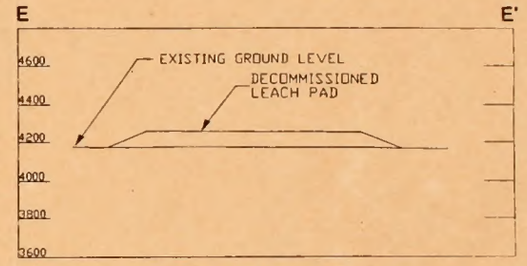
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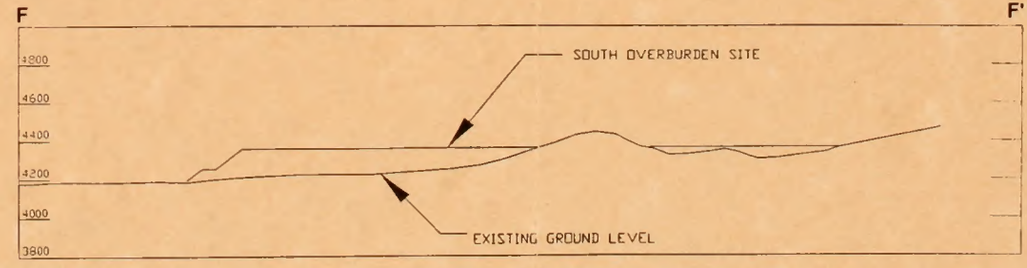
SECTION C-C'



SECTION D-D'



SECTION E-E'



SECTION F-F'

FIGURE 1.7

POST MINING TOPOGRAPHY AND CROSS SECTIONS

CASTLE MOUNTAIN PROJECT

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5. Along the south face of the South Overburden Pile, a flat bench will separate two terraces sloped at 1.5H:1V to achieve an overall 2H:1V slope. Studies performed by Steffan Robertson and Kirsten on overburden materials have determined they will be stable at this slope angle.

6. The currently designed South Overburden Pile has 28 acres of side slopes. Reducing these slopes to 3H:1V would result in an additional 20 acres of side slopes, almost doubling the existing side slope acreage. In the desert environment, moisture occurs in periodic events causing significant surface water flows. The 1.5H:1V side slopes on the South Overburden Pile will not be packed and will allow a significant amount of water penetration and reduce surface water flow down the slopes. If the side slopes are changed to 3H:1V, material on these slopes will be compacted by equipment. This will produce a surface which will be more resistant to water penetration, resulting in more surface water flow. If growth media, material that is finer than overburden material, is placed and packed on the 3H:1V slope, then this surface water problem will be accentuated. Reducing slopes to 3H:1V would likely result in more acreage becoming exposed to erosion and, due to surface run-off down the slopes, the erosion problems on side slopes would be magnified.

7. Growth media is limited on the site and, as a result, soil islands will be used to maximize benefits from the limited amount of salvaged material available. Growth media must be used in the most efficient manner possible, that is, on the top of the overburden and leach pad areas. There will be insufficient growth media to place it on side slopes and still provide adequate coverage for the tops of the overburden and leach pad areas.

8. There are rocky slopes on the sides of the mountains immediately north and east of the project site that have slopes ranging from as steep as 1.5H:1V to less than 3H:1V. Owing to the more than three mile distance between the overburden site and the nearest road to the south (the East Mojave Heritage Trail), most viewers from this road would be unable to distinguish between surfaces sloped at between 2H:1V and 3H:1V.

9. In summary, the final slopes designed by Viceroy will disturb less land, maximize the amount of growth media available for use on other areas, provide stability, and conform to the natural topographic contour.

10. Existing roads on the project site already provide access to the Administration, Contractor's Shop, and Crushing Plant Areas. Improvements to these roads will be limited to widening present alignments to approximately 25 feet. On new road construction, "cut and fill" will be minimized by following existing topography. The Overland Conveyor between the Crushing Plant and Leach Pads will span the dry wash. During project decommissioning, side hill cuts in roads to be abandoned will be reclaimed, by pulling the material cast over the side back up onto the road with a backhoe, then seeded. Roads to be reclaimed in flat topography will be ripped and scarified to eliminate compaction. Bermed material will be replaced, then seeded.

1.10.2 PUBLIC SAFETY

1. Public safety during the operational period will be provided by restricting access to operating areas with fences and gates. All visitors will be required to register at the security desk, and must adhere to procedures mandated by the Federal Mine Safety and Health Administration.

2. Public safety will be maintained following project completion by reclamation procedures that will include slope stabilization where required, removal of buildings, structures and equipment, and use of barriers such as berms in areas that would otherwise provide vehicle access into mine pits.

3. Fencing will be dismantled around areas that have been revegetated after vegetation has matured to the point where it can withstand grazing activity. The determination of when fencing should be removed will be made by BLM.

1.11 POST-MINING HYDROLOGY

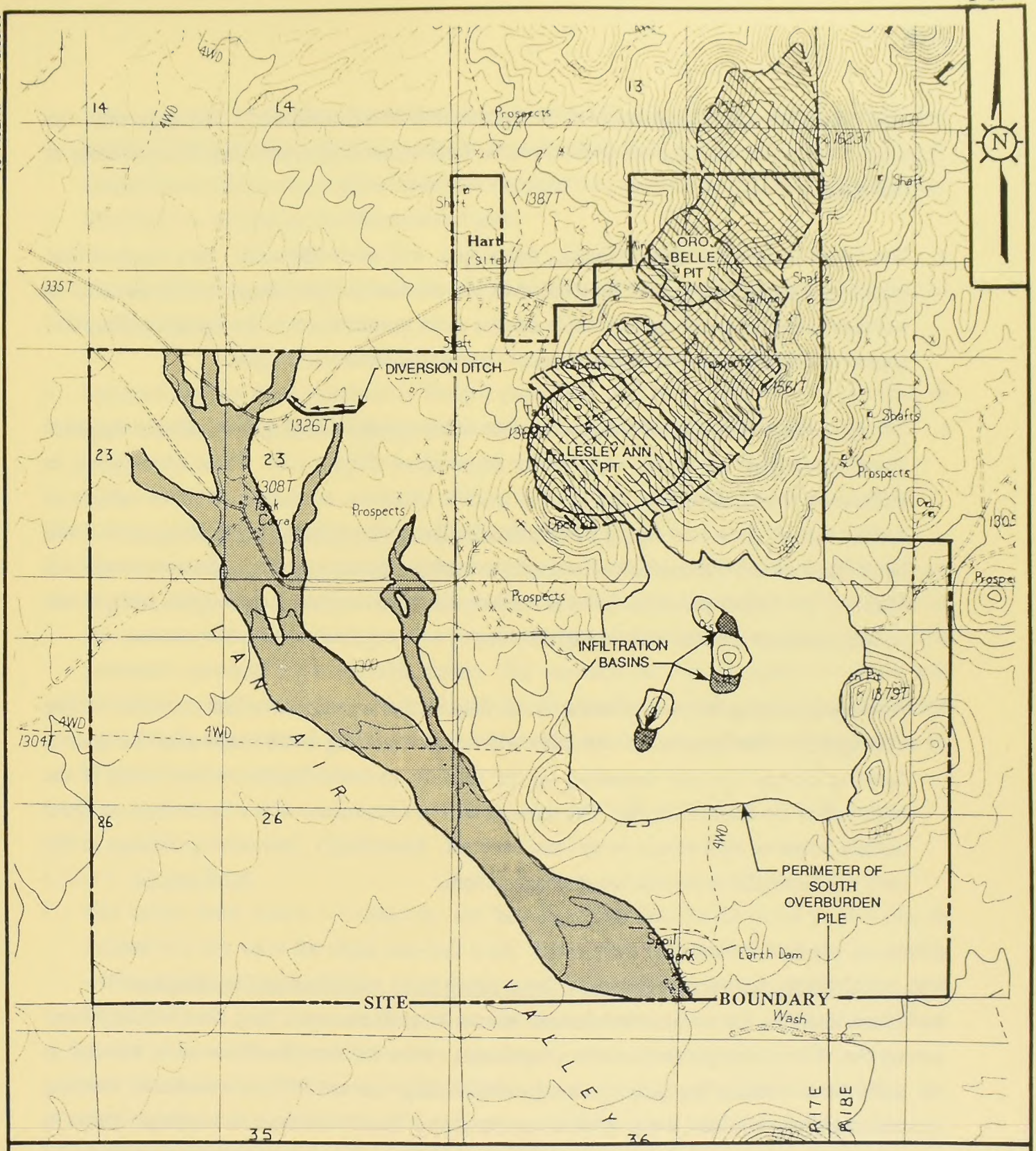
1.11.1 SURFACE WATER

1.11.1.1 Mine Pits, Overburden Pile, and South Clay Pit Reclamation Area

1. Surface waters flowing from the project site ultimately reach Sacramento Wash, which drains the northeastern portion of Lanfair Valley. The drainage area feeding Sacramento Wash covers approximately 240 square miles (153,000 acres).

2. The open pits (135 acres) are located at or near the crest of their respective watersheds (340 acres), as shown in Figure 1.8 (In-Pit Catchment Area, Infiltration Basins and Diversion Ditch). Surface run-off from these watersheds will flow into the pits. The affected watershed

88-148B/RP REV 5/22/90



LEGEND

100 YEAR FLOOD PLANE

IN-PIT FLOW CATCHMENT BASIN

0 .5 1 MILE

SCALE

REFERENCE: 7.5 MINUTE U.S.G.S. TOPOGRAPHIC MAPS OF HART PEAK, CALIFORNIA-NEVADA, AND CASTLE PEAKS, CALIFORNIA. DATED: 1984

FIGURE 1.8

IN-PIT CATCHMENT AREA, INFILTRATION BASINS AND DIVERSION DITCH

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

will constitute only 0.2 percent of the Sacramento Wash watershed. Consequently, the amount of water entering the pits will have little effect on post-mining flow volumes at Sacramento Wash.

3. The South Overburden Pile, including side slopes, will cover 300 acres. As a result of haul trucks depositing overburden material over the crest of the pile, larger rocks will tend to advance to the bottom of the pile, while smaller rocks remain closer to the top of the pile. This natural size segregation will create an under-drain at the bottom of the pile.

4. The top surface of the South Overburden Pile will be graded (ranging from 0.5 to 1.0 percent slope) away from the crests, into interior depressions (Figure 1.8). Three depressions, or infiltration basins, have been designed at specific locations, to accommodate the volume of surface run-off generated during a Probable Maximum Precipitation event. Coarse rock will be dumped on the infiltration basin slopes to inhibit migration of fines. Surface water will flow into the basins, percolate down to the under-drain at the bottom of the pile, and exit into existing drainage patterns at the toe of the pile.

5. At present, most surface run-off in the South Clay Pit Reclamation Area collects in the existing clay quarry. Reclamation of this area will involve placing overburden over the quarry, forming several terraces extending up the hillside, to cover the lower two-thirds of the highwall of the South Clay Pit. The terraces will be constructed with a back-slope, to direct surface water on each terrace away from the crest. Accordingly, post-mining drainage in this area will be similar to the existing drainage pattern.

1.11.1.2 Crushing and Process Facilities, Heap Leach Pads, and Solution Tanks/Basins

1. These facilities, the Administration Area and the Mine Contractor's Shop Area will be located on the alluvial fan portions of the project site. Sites for these facilities were selected to conform to existing topography, thereby minimizing "cut and fill" earthwork and avoiding encroachment into major dry washes that cut across the alluvial fan. Accordingly, flows in these dry washes (which occur only during or following large storm events) will not be affected. Sheet-flow upgradient from these facilities will be intercepted and diverted around the facilities in small V-ditches. Except for Leach Pad Areas, these ditches will be filled in at project decommissioning.

2. After spent ore on the Heap Leach Pads has been detoxified, heap sides will be regraded and flattened as discussed in Section 1.10. V-ditches installed up-gradient from the leach pads during their construction to divert sheet-flow around the pads will be left in place, to continue diverting run-off around decommissioned pads.

3. The upper surface of Heap Leach Pads will be shaped to retain moisture, by creating an undulating surface.

4. Solution storage areas adjacent to Heap Leach Pads will be reclaimed by backfilling to approximately their original contour and as a consequence will not collect water.

1.11.1.3 Leachate from Ore, Protore, and Overburden

1. Precipitation percolating through spent heap leach ore and overburden materials will not degrade surface water or ground water quality. As discussed in Section 2.4.4, samples of ore, protore, and overburden have been subjected to geochemical testing to determine the acid generation potential and extractable metals. The materials are slightly alkaline in nature, will not produce acidic leachate conditions, and the measured concentration of metals dissolved under the State-mandated WET procedure were well below the concentrations considered to be of potential concern by the State.

1.11.1.4 Access Road

1. The access road, where it crosses the site boundary into Section 23 at the project site, is located in a dry wash for about one-half mile. Storm flow calculations indicate the road is within the flood plain of a 24 hour storm event with a return period of 100 years (see Figure 1.8). In such an event, the road would be under 6 to 12 inches of water for a short period of time. Flooding will not be a significant inconvenience, owing to the infrequency with which severe storms occur and the fact that there are existing alternative roads within the site boundary that could be used, if necessary, to reach the access road. Accordingly, Viceroy does not anticipate changing the road alignment in this area.

1.11.2 GROUND WATER

1. Modeling undertaken in connection with preparation of the Draft EIS/EIR demonstrated that the cone of depression which will develop around the well field will be eliminated within 30 years after pumping ceases. Recharge to the aquifer is expected to refill the cone of depression within that time frame. The cone of depression will be monitored during operations using monitor wells in the West Well Field and down-gradient, between the well field and Piute Spring.

2. Sites occupied by process facilities, as well as reclaimed roads, leach pads, and overburden disposal areas, are not expected to affect post-mining hydrologic conditions, since these sites are not part of the recharge zone for the local aquifer. Condemnation drilling completed in the leach pad and overburden areas demonstrated that the ground water table in these areas is, on average, at least 550 feet below surface topography.

3. Heap leach facilities will be monitored, using leak detection systems beneath the pad liners, the emergency solution storage basin, and the stormwater basin. The design and installation of these leak detection systems must comply with CCR, Title 23, Subchapter 15 regulations, and have been submitted to the RWQCB for approval as part of the waste discharge permit application.

4. Wells will not be installed specifically to monitor ground water beneath leach pad or overburden pile areas. The depth to ground water, potential seepage quantities, and low vertical permeability of the soils and rock below these areas render any type of ground water monitoring impractical and ineffective in terms of monitoring the facility. A vadoze zone monitoring system will be installed beneath the heap leach pads. The vadoze zone is a subsurface zone starting at ground level and extending down through the subsurface to the ground water level.

5. The monitoring system for leach pads and solution storage basins will be operated to provide the regulatory agencies and Viceroy with the earliest possible warning if a release has occurred. Three separate leak detection systems will be installed: under the emergency solution storage basin; the stormwater catchment basin, and the leach pad itself.

6. The leak detection systems for the basins will be placed between the double liners in each basin. The systems will consist of a geodrain sloping to a depression (or sump) in one corner

of each basin. The sumps will be monitored by an 8-inch diameter riser pipe connected at the low point of the system. Each riser pipe will be capable of accommodating a pump to dewater the leak detection system prior to remedial action.

7. The leach pad leak detection system will be placed beneath the pad liner and geotextile underliner. The system consists of slotted HDPE pipes, which will be placed within fill used to level topographic lows within the leach pad site. The system will be monitored through an HDPE pipe extending through the perimeter berm and connected to a sump and riser pipe assembly.

8. Should significant seepage indicating major liner failure be detected from either basin, that basin will be drained for repair. Should significant seepage indicating major liner failure be detected from any pad cell, that cell will be decommissioned and put out of use or cleared and inspected. Liners and welded seams will be inspected for holes, tears, and defects. Areas of the liners requiring repair will be patched or replaced depending upon the extent of the problem.

9. The collection ditches, HDPE and steel pipe and diversion systems will be thoroughly examined monthly to ensure that the integrity and performance of the system is maintained.

10. The bottoms of the open pits will be above the water table. Accordingly, these excavations will not intercept ground water flows, and localized dewatering of the aquifer will not occur. To the contrary, a small amount of recharge may occur, since the pits will intercept surface flows from approximately 340 acres of watershed surrounding the pits. Surface run-off from this watershed will collect in the bottom of the pits, aiding in the development of wildlife habitat in this area. While most of the water entering the pits is expected to evaporate (given the high evaporation rates that are characteristic of this area of the East Mojave Desert), a small portion may infiltrate into the local ground water through fractures in the rock.

1.11.3 DRAINAGE, EROSION, AND SEDIMENTATION CONTROL

1. The mine pits will be located at or near the crest of their respective watersheds, as described in Section 1.11.1. Any surface water and associated sediment within the perimeter of the in-pit catchment area will collect at the bottom of the mine pits (see Figure 1.8).

2. Drainage for the post-mining South Overburden Pile and South Clay Pit Reclamation Area is discussed in Section 1.11.1. During development of these areas, a gradient ranging between 0.5 and 1.0 percent will be maintained to ensure surface waters flow away from, rather than over, the crests. To reduce wind erosion, reclamation activities will be initiated as soon as practicable after each site is disturbed.

3. Facilities needed to operate the project during the first several stages have been located out of the flood plains associated with the dry washes that traverse the site. Should the northeastern leach pad be needed, however, it will be necessary to construct a diversion ditch to channel storm flows away from the north end of that pad. The conceptual location of the pad and diversion ditch are shown in Figure 1.8, in relation to the flood plain for the 24-hour, 100-year flood event. Since the pad has not been designed in detail, it is not possible at this time to provide precise data on the configuration of the diversion ditch. Detailed design information on this ditch will be submitted to the RWQCB as part of the submission for a waste discharge permit to build and operate the northeastern leach pad. As a matter of sound engineering practice, the ditch and any associated berms will be designed to convey the 24-hour, 100-year storm event with a minimum freeboard of one foot. The slope and alignment of the ditch will be designed to minimize flow velocities and subsequent erosion from flood waters.

4. Crusher, Process Plant, Administration, and Mine Contractor's Shop Areas have been located away from major washes and have been designed to conform to existing topography as much as practicable. A description of these areas after decommissioning is contained in Section 1.11.1. Since the topography in these areas is quite gentle, erosion and sedimentation problems are not anticipated.

5. Solution Storage Areas and Heap Leach Pads have been designed to operate as closed systems. As a result, any sediment would be contained within these areas. The post-mining description of these areas is given in Section 1.11.1.

6. A description of present and future road alignments is given in Section 1.10.

7. Seedbank and growth media handling and stockpiling procedures are described in Section 1.5.4.

8. A description of mulching and its use to control erosion is given in Section 1.5.15. Erosion will be assessed annually. Sites showing evidence of rill and gully erosion will be bermed and terraced. Areas with active erosion will be graded and seeded prior to the next growing season.

CHAPTER 2.0
MINING PLAN

2.0 MINING PLAN

2.1 INTRODUCTION

1. This chapter is a summary of information presented in the Draft EIS/EIR and Supplement. If more detailed information is desired concerning the topics discussed in Chapter 2.0, the reader should consult the Draft EIS/EIR and Supplement.

2. The Castle Mountain Project will operate as an open pit heap leach mine, using established methods common to the mining industry. The process typically used to recover gold by heap leaching methods is depicted as a block diagram in Figure 2.1 (Generalized Heap Leach Mining Operation).

3. The first step in this process involves excavation of the ore. Ore is commonly concealed beneath rock or alluvium that does not contain precious metals. This rock is therefore first removed and discarded at the overburden pile. When the orebody is exposed, ore grade material is excavated and delivered to a crusher, where it is reduced to the size of gravel and agglomerated to bind fine particles. The crushed and agglomerated ore is then transported to heap leach pads via haul trucks and/or a system of conveyors. Protore (material containing a lesser degree of gold) excavated from the pit is stored in protore stockpiles for potential processing at a later time, when improvements in prices and/or technology could allow profitable treatment of such material for additional gold recovery. Unmineralized rock between zones of ore is discarded at the overburden pile.

4. Viceroy intends to process the protore stockpiles. However, if economic conditions are unfavorable when these stockpiles are scheduled to be processed, the upper surfaces would be prepared for revegetation. Since these stockpiles are a resource for the future, and due to the limited amount of growth media available, growth media would not be placed on these stockpiles.

5. Ore is heaped onto a pad that is underlain by a synthetic liner. A dilute sodium cyanide solution (250 parts per million) is distributed across the top of the heap by drip irrigation. The solution trickles through the material, dissolving the gold (and silver) in the ore. The pregnant (gold-bearing) solution drains from the heap through pipes and is collected in solution storage tanks.

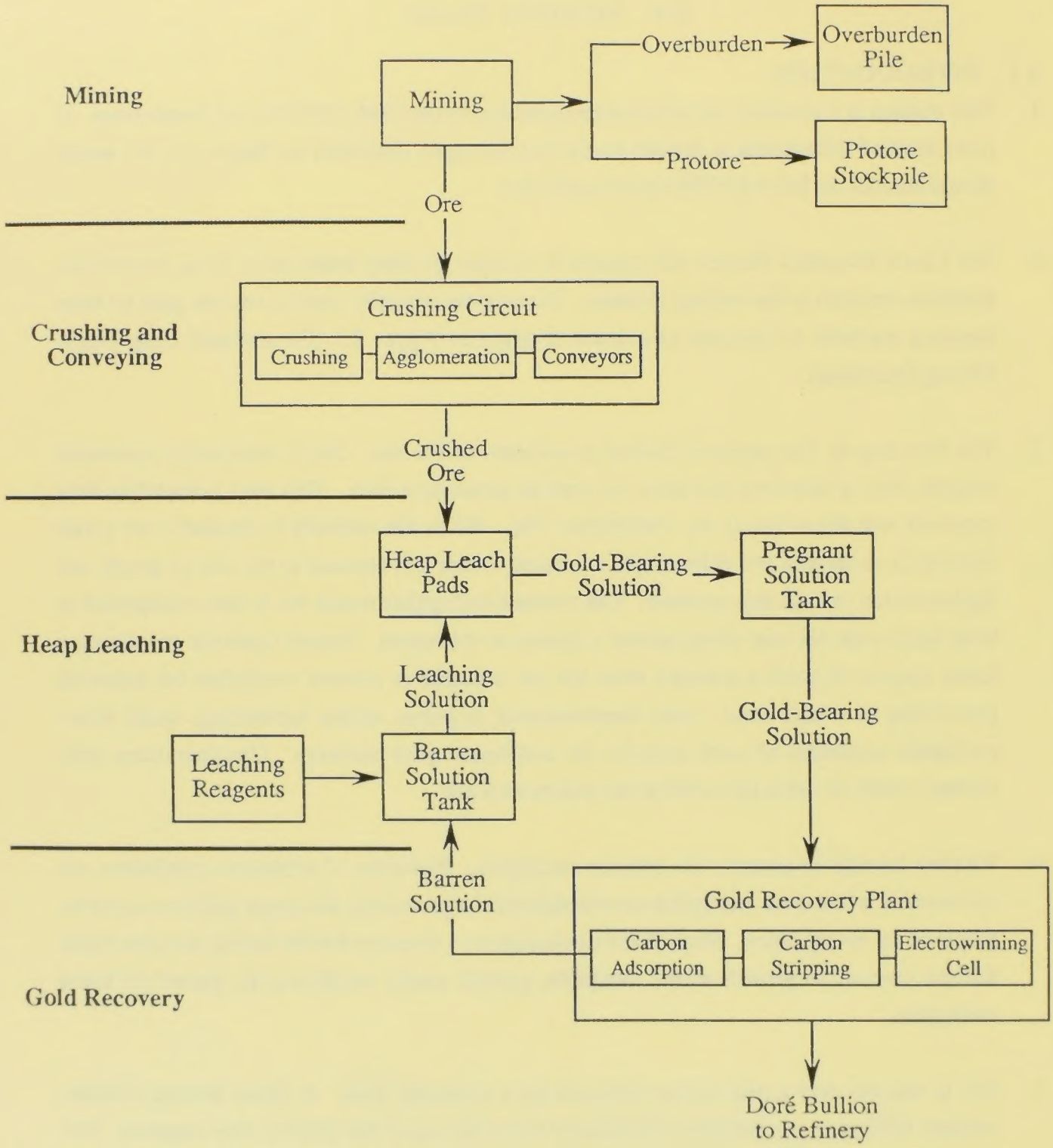


FIGURE 2.1

GENERALIZED HEAP LEACH MINING OPERATION

CASTLE MOUNTAIN PROJECT

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6. Pregnant solution is then pumped through pipes from the solution storage tanks to the gold recovery plant where vessels containing activated carbon adsorb the gold (and silver). After the gold has been adsorbed onto the carbon, the now "barren" solution is pumped to a storage tank where reagents, primarily caustic soda and cyanide, are added before the solution is recycled to the heaps to continue the leaching process. Since solution is recycled, the leaching system operates with no discharge to the environment.

7. The gold-bearing carbon is chemically treated to release the gold (stripped or eluted) and is reactivated by heating for future use. The resultant gold-bearing strip solution, more concentrated than the original pregnant solution, is treated by electrolysis in an electrowinning cell. In the cell, gold is electrically plated onto steel wool. Any silver that was dissolved and carried into the pregnant solution follows the gold through the process and is also plated onto the steel wool. After electrowinning, the steel wool is melted in a furnace and a doré (bar of impure gold and silver) is produced. The doré is then sold or shipped to a refinery for further purification.

8. The generalized process description given above is presented in greater detail in the following sections as it will be adapted to the Castle Mountain Project.

2.2 MAJOR PROJECT COMPONENTS

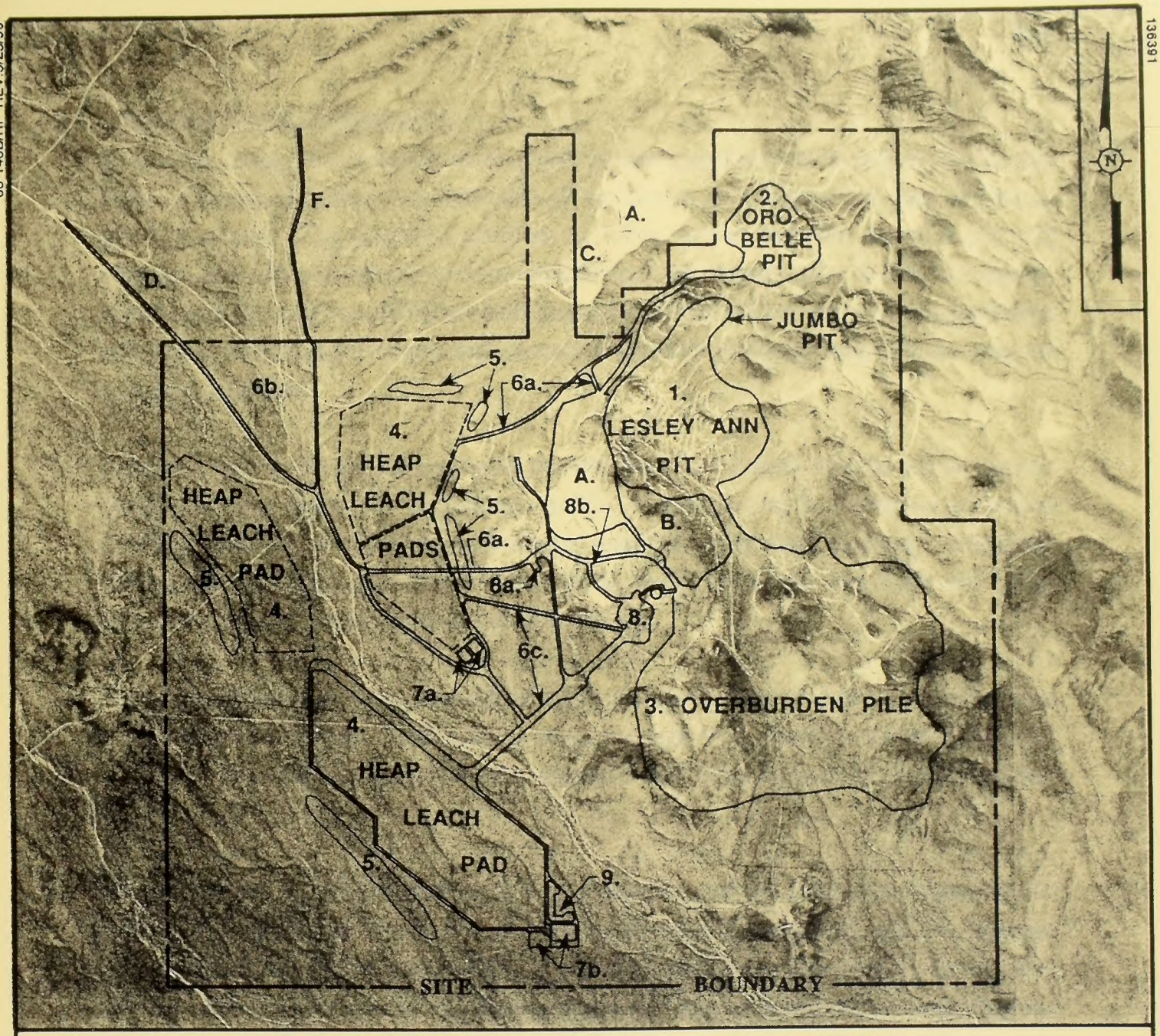
1. The major components of the Castle Mountain Project are illustrated in Figure 2.2 (Preliminary Site Plan). This arrangement of the major components has been developed based upon numerous considerations, including:

   - **Mine Pit** locations and configurations are dictated by geologic locations of orebodies as defined by exploratory drilling.
   - **Overburden Pile and Crushing Facilities** will be located near mine pits to minimize haul distances. The overburden pile will be partially surrounded by low hills.
   - **Heap Leach Pads** will be located on gentle slopes at lower onsite elevations. This will minimize grading necessary for drainage. Leach pads have been located outside the primary onsite drainage area in order to minimize disruption of natural drainage.
   - **Solution Storage Tanks and Gold Processing Plant** are located downslope of leach pads so solution flows by gravity, minimizing pumping costs and the length of pipes handling solution flow.

   Each of these major components is described below with respect to planned characteristics and operation.

88-148B/RP REV.5/25/90

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MAJOR FACILITIES SUMMARY

FACILITY	ACREAGE
1. LESLEY ANN/JUMBO PITS	100
2. ORO BELLE PIT	35
3. OVER BURDEN PILE	300
4. HEAP LEACH PADS	330
5. SOIL STORAGE	70
6. ROADS	30
a. HAUL ROADS	
b. ACCESS ROADS	
c. CONVEYORS/HAUL ROADS	
7. SOLUTION STORAGE AREA	10
a. PREGNANT AND INTERMEDIATE	
b. PREGNANT, INTERMEDIATE AND BARREN	
8. CRUSHING AREA	10
a. ADMINISTRATION BUILDING/PARKING	
b. MINING CONTRACTOR'S SHOP	
9. PROCESSING PLANT AREA	5
PROCESS BUILDING, WAREHOUSING	
SUBTOTAL	890
OFFSITE ACCESS	
ACCESS ROUTE IMPROVEMENTS	40
TOTAL	930

SITE FEATURES

A. CLAY PIT
B. BIG CHIEF HILL
C. HART (TOWNSITE)
D. HART MINE ROAD
E. DRAINAGE WASH
F. PROJECT ACCESS ROAD

FIGURE 2.2

PRELIMINARY SITE PLAN

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

2.3 PRODUCTION SCHEDULE

1. Lesley Ann, being the first deposit to be mined, has been more extensively drilled than the Oro Belle or Jumbo deposits. The core area of the Lesley Ann deposit has been drilled on 100-foot centers. This spacing is adequate to define "proven reserves" for mine planning purposes, although mineralized structures exist beyond the present Lesley Ann Pit boundaries. Results from pit perimeter definition drilling and data obtained from actual mining conditions will dictate whether such mineralized structures would be profitable under the then-current economic conditions.

2. Occurring later in the mining sequence, the Oro Belle and Jumbo deposits are, at present, drilled at a lower density than the Lesley Ann Pit. As a result, Oro Belle reserves are termed "probable reserves," while Jumbo reserves are classified as "geologic reserves." Additional drilling and associated geological studies will be completed on the Oro Belle and Jumbo deposits to develop "proven reserves" prior to mining.

3. The Castle Mountain Project production schedule reflects the level of engineering information available for each pit area. Total material mined by stage (time period) is shown in Table 2.1 (Estimated Annual Production). The total material mined is that required to supply 30 million tons of ore.

4. For the first several years of operation, it is anticipated that ore and overburden mining will be done by an independent contractor. All mining personnel, equipment, and site facilities needed to complete the contract will be furnished by the Mining Contractor. Viceroy will provide supervision, engineering, grade control, and survey personnel to work with the mining contractor's crews. Mining will usually be scheduled for two 10-hour shifts per day, operating six days per week. Crushing and processing operations are scheduled for 24 hours per day, seven days per week. These schedules will provide effective use of capital-intensive mining, crushing, and processing equipment.

5. While crushing and processing facilities are under construction during the preproduction period (Stage 1), approximately 13 million tons of material will be removed from the Lesley Ann Pit. The mining crews will work up to two 10-hour shifts per day, seven days per week, during this high production period. At the conclusion of this 7-month period, adequate working space will have been developed in the pit, such that the crushing and process plants can be supplied on a sustained basis at a rate of approximately three million tons of orebearing material per year.

TABLE 2.1

ESTIMATED ANNUAL PRODUCTION
(Quantities in Millions of Tons)

PERIOD	TIME	PIT(S)	OVERBURDEN	ORE AND PROTORE	INCREMENTAL	CUMULATIVE
Stage 1	7 months	Lesley Ann	13	--	13	13
Stage 2	Year 1	Lesley Ann	15	3	18	31
Stage 3	Year 2	Lesley Ann	15	3	18	49
Stage 4	Year 3	Lesley Ann	7	3	10	59
Stages 5 through 7	Years 4-10	Lesley Ann/ Jumbo/Oro Belle	10	21	31	90
TOTAL			60	30	90	90

88-148B (7/25/90)

Note: The "Ore and Protore" column includes all resources which are currently classified as proven, probable, and possible, plus protore material stockpiled on the overburden disposal area.

6. Approximately 15 million tons of overburden and three million tons of ore will be mined in each of Stages 2 and 3. Each stage covers a 12-month period. In subsequent stages, as the Lesley Ann Pit is deepened, the annual tonnage of overburden mined will decrease, resulting in fewer total tons mined per year.

7. Mining will be completed in the Lesley Ann and Oro Belle Pits at the end of Stages 5 and 6, respectively. The Jumbo Pit will be completed during Stage 7, along with all low grade ore and protore stockpiled adjacent to the Primary Crusher.

8. An estimated 60 million tons of overburden and 30 million tons of ore will be excavated from the pits and deposited in various locations. Approximately 4.5 to 5.0 million tons of overburden will be placed in the South Clay Pit Reclamation Area, and between 4.0 and 4.5 million tons could be used to reclaim the North Clay Pit. The remaining overburden material will be placed in the South Overburden Pile. Overburden at the South Clay Pit Reclamation Area will be placed to form four terraces, while in the North Clay Pit, overburden would be placed in five shallow terraces. The terraces have been designed to cover the light colored pit walls exposed by previous clay quarrying activities.

9. Overburden placed in the South Overburden Pile will ultimately cover an area of about 300 acres. Development of this overburden pile will initially take place on a single lift, to create a reasonably level surface for the placement of stockpiles of mineralized material. After sufficient room has been established for these stockpiles, the south face of the overburden pile will be advanced by placing overburden material in two lifts along the southern perimeter of the pile. These lifts will produce an overall final slope of 2H:1V (i.e., two horizontal to one vertical). At completion, the south face will have a shallow scalloped shape, to more closely replicate the shape and appearance of other hillsides in the area of the project.

10. Stockpiles of various grades of mineralized material hauled from the open pit will be created on top of the South Overburden Pile during mining operations. Total tons of material stockpiled will depend on economic considerations and distribution of gold within the pits. A high grade stockpile will be placed adjacent to the Primary Crusher. Low grade and protore stockpiles will be placed south of the high grade stockpile. While some stockpiled material may, from time to time, be crushed and processed to supplement ore from the pit, it is anticipated that most low grade and protore material will be processed during Stage 7.

2.4 MINING PLAN

2.4.1 GROWTH MEDIA

1. Results of a soil survey conducted over the project site are described in Section 4.2.4. Growth media suitable for revegetation, as described in the soils report, will be salvaged in stages, in a coordinated manner with preproduction mining, construction, and operations. Staging will minimize the amount of land that will be disturbed prior to the time at which a particular tract is needed for placement of material, either ore or overburden.

2. Growth media will be salvaged from the following areas:

   - Lesley Ann/Jumbo Pits
   - South Overburden Pile
   - Heap Leach Pads
   - Solution Storage Areas
   - Crushing Area
   - Processing Plant Area

   Material from these areas will be stockpiled in nearby locations and used for reclamation as early as practicable. Estimated salvage volumes and stockpile locations are detailed in Section 2.4.3.

2.4.2 MINING

2.4.2.1 Pit Design

1. The Castle Mountain Project, as presently conceived will consist of two mine pits, known as Lesley Ann/Jumbo and Oro Belle. Each pit will be developed using conventional open pit mining methods. Materials produced during mining operations will include growth media, overburden (both consolidated and unconsolidated), ore, low grade ore, and protore. The estimated dimensions of the Castle Mountain Project mine pits, along with associated overburden and ore tonnages, are shown in Table 2.2 (Estimated Pit Characteristics) and Table 2.3 (Estimated Pit Dimensions by Stage).

2. Open pit mining is customarily used to develop deposits in which mineralization is reasonably near the surface and distributed in a manner that permits the use of bulk mining techniques. Mining equipment removes mineralized rock and unmineralized material (overburden) by excavating a series of mining benches. The pit boundary configuration is determined by complex interrelationships involving a number of factors, including the extent, grade and metallurgical recovery of mineralized material, capital and operating cost parameters, and geotechnical design considerations.

TABLE 2.2

ESTIMATED PIT CHARACTERISTICS

DIMENSION	MINE PITS[1]	
	LESLEY ANN/JUMBO	ORO BELLE
Area	90 to 110 acres	30 to 40 acres
Length (north-south)	2,200 to 2,600 feet	1,300 to 1,600 feet
Width (east-west)	2,100 to 2,500 feet	1,300 to 1,500 feet
Maximum depth	600 feet	200 feet
Minimum anticipated ore reserves	13 million tons[2]	7 million tons[2]
Estimated possible additional ore and protore resources[3]	8 million tons	2 million tons
Approximate overburden volume	50 million tons	10 million tons

88-148B (7/23/90)

(1) For the Lesley Ann and Oro Belle deposits, the minimum values for pit dimensions are based on known proven or probable ore reserves. The maximum values shown for pit dimensions are based on preliminary engineering projections that include possible mineralization and protore volumes. Definition drilling and final engineering based on initial pit excavation experience will be used to determine the final size and configuration of the pits.

(2) Based on the current status of drilling to delineate ore reserves and engineering design of the ore deposits, the minimum anticipated volume of ore shown for the Lesley Ann/Jumbo Pit is considered to be proven reserves. The minimum volume shown for the Oro Belle Pit is considered to be probable reserves.

(3) Possible additional ore and protore resources for both pits are based upon geologic interpretation of drilling data that indicates the presence of mineralization. Protore volumes within the Lesley Ann/Jumbo Pit (i.e., material that may become economic in the future) are included in this category.

TABLE 2.3

ESTIMATED PIT DIMENSIONS BY STAGE
(Feet)

AREA	STAGE	EAST TO WEST	NORTH TO SOUTH
Jumbo South/Lesley Ann	1	2,400'	2,100'
Jumbo South/Lesley Ann	2	2,400'	2,400'
Jumbo South/Lesley Ann	3	2,400'	2,600'
Jumbo South/Lesley Ann	4	2,400'	2,600'
Jumbo South/Lesley Ann (Complete)	5	2,400'	2,600'
Oro Belle	5	1,400'	1,500'
Oro Belle (Complete)	6	1,400'	1,500'
Jumbo	6	1,600'	1,300'
Jumbo (Complete)	7	1,600'	1,300'

88-148B (7/26/90)

3. Pit designs at the Castle Mountain Project are at different stages of completion. Designs are based on density of exploratory drill holes in the respective pit areas, estimated value and distribution of the resource, and related economic and geotechnical factors. Most of these factors are subject to change during the life of the mine. As is customary in the mining industry, in order to maximize the recovery of the resource, pit designs will be reevaluated several times during the course of mining in response to these changing factors.

4. Estimated metallurgical recoveries are derived from laboratory tests of representative ore samples and are the best estimates prior to having actual operating data for evaluation. These estimates will be continually monitored during the life of the operation. An increase in value of the resource could result in the need for expanded pit boundaries, as mineralization in the walls or floor of the pit which was previously uneconomic could become profitable to mine. Reduced costs or improvements in recovery could have the same effect.

5. The current pit designs will be refined and optimized with further "definition" drilling to better determine the extent of mineralized material in the pit and to more accurately predict ore reserves. Timing of these drilling programs is dictated by when the drill hole information would be required for detailed mine planning (e.g., production scheduling).

6. Pit slopes and bench heights are influenced by geological and geotechnical characteristics along with grade control considerations. In competent and stable rock, the bench configuration will consist of a series of three 20-foot high benches with an approximate individual bench face angle of 63 degrees. A safety bench will be left at the base of each 60-foot pit wall segment. The width of this bench will be variable, based on a geotechnical assessment of rock strength and stability. The overall slope angle will not exceed 60 degrees in competent rock. A similar configuration will be developed in poorly consolidated or clay altered zones, except the safety bench will be wider, resulting in an overall slope angle of 40 degrees.

7. Bench heights and safety berm widths have been designed based on data available prior to pit development. Geological and geotechnical characteristics of the materials exposed during pit excavation will be monitored regularly. Designed slopes and bench heights will be modified to accommodate safety and operating conditions in order to produce final pit profiles with pit wall angles compatible with rock strengths.

8. Water has not been encountered during exploration drilling within pit areas, down to depths of 400 feet. Some holes did encounter small volumes of water at depths of 500 to 550 feet. The pits are expected to be above the water table and so should not produce water.

2.4.2.2 Operations

2.4.2.2.1 Pit Characteristics

1. An estimated 135 acres will ultimately be affected by mining the Castle Mountain ore reserves. The mining and reclamation sequence is based upon economic considerations, known engineering information, and environmentally sound procedures. As is typical of most mining operations, more precise data will be generated as operations proceed, leading to engineering refinements and other modifications to operational plans in future years. Departures from the procedures described herein will be submitted to the appropriate governmental agencies for approval prior to implementation.

2. The current pit design for the Lesley Ann deposit and associated cross-sections are shown in Figure 2.3 (Current Lesley Ann Pit Design) and Figure 2.4 (Cross Sections Through the Current Lesley Ann Pit Design). Included in the cross-section is the estimated boundary between mineralized and non-mineralized rock. As described earlier, a pit design is based on a number of economic and engineering parameters. The design shown in these two figures is based on a conservative set of parameters. A more optimistic set of design parameters would result in a larger pit, encompassing more of the mineralized rock. The design for the Oro Belle deposit is given in Figure 2.5 (Current Oro Belle Pit Design and Associated Cross Section).

3. Haul roads from the mine pits to the Overburden Disposal Areas and Primary Crusher will be about 60 feet wide to permit two-way travel for haul trucks, with safety berms and drainage ditches. Maximum grades of in-pit haul roads will be ten percent. Two safety runaway ramps have been designed into the Lesley Ann Pit. These will be located along the final wall, placed to take advantage of the existing safety benches. Runaway ramp entrances will be located (heading downgrade) at road elevations of 4,200 and 4,040 feet. The runaway ramps will be 40 feet wide and approximately 300 feet long, with ramp grades up to 25 percent.

4. More information on the design and operation of the mine pits is given in Section 3.2.4.1 of the Draft EIS/EIR.

88-148B/RP REV. 4/24/90

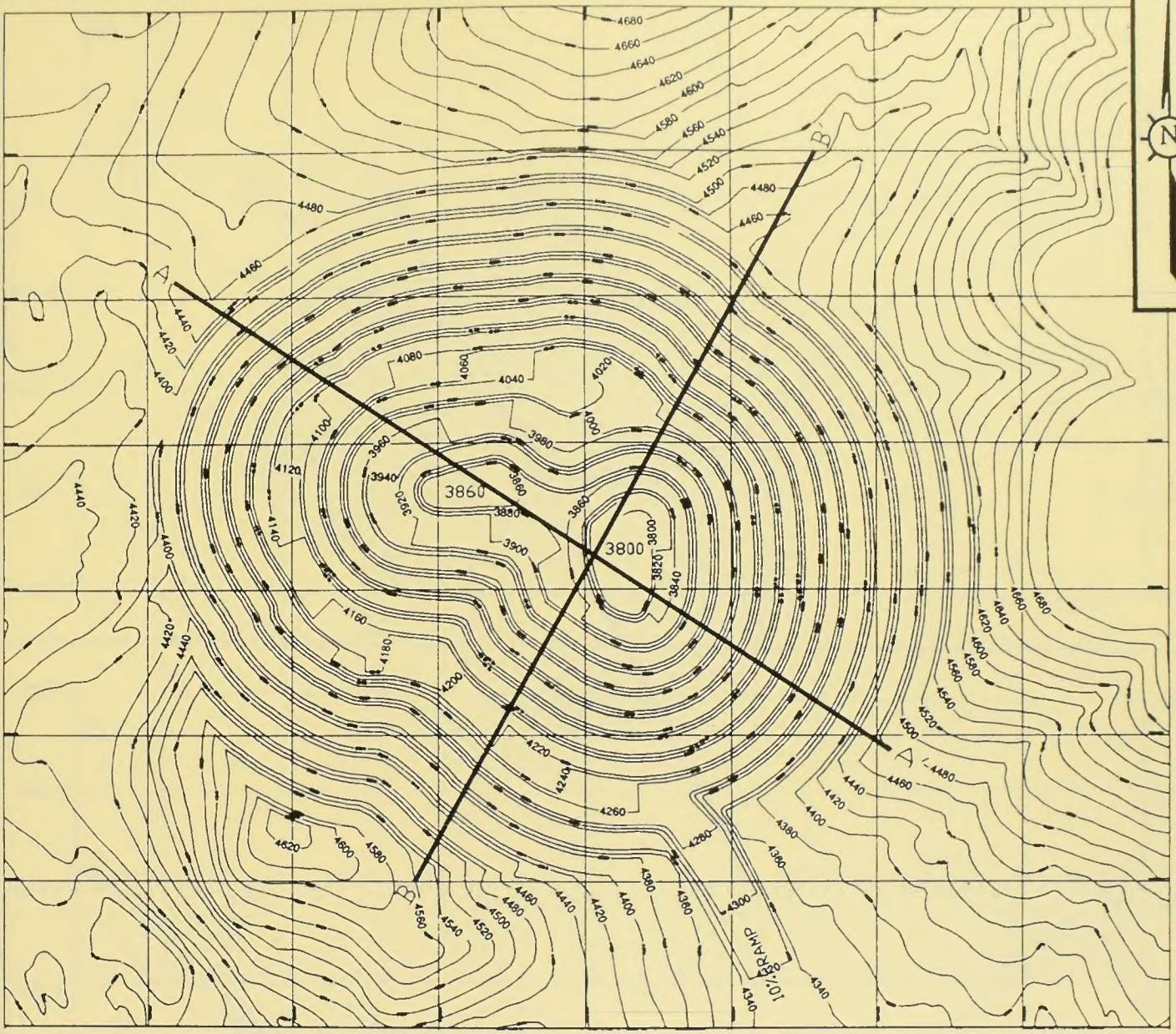


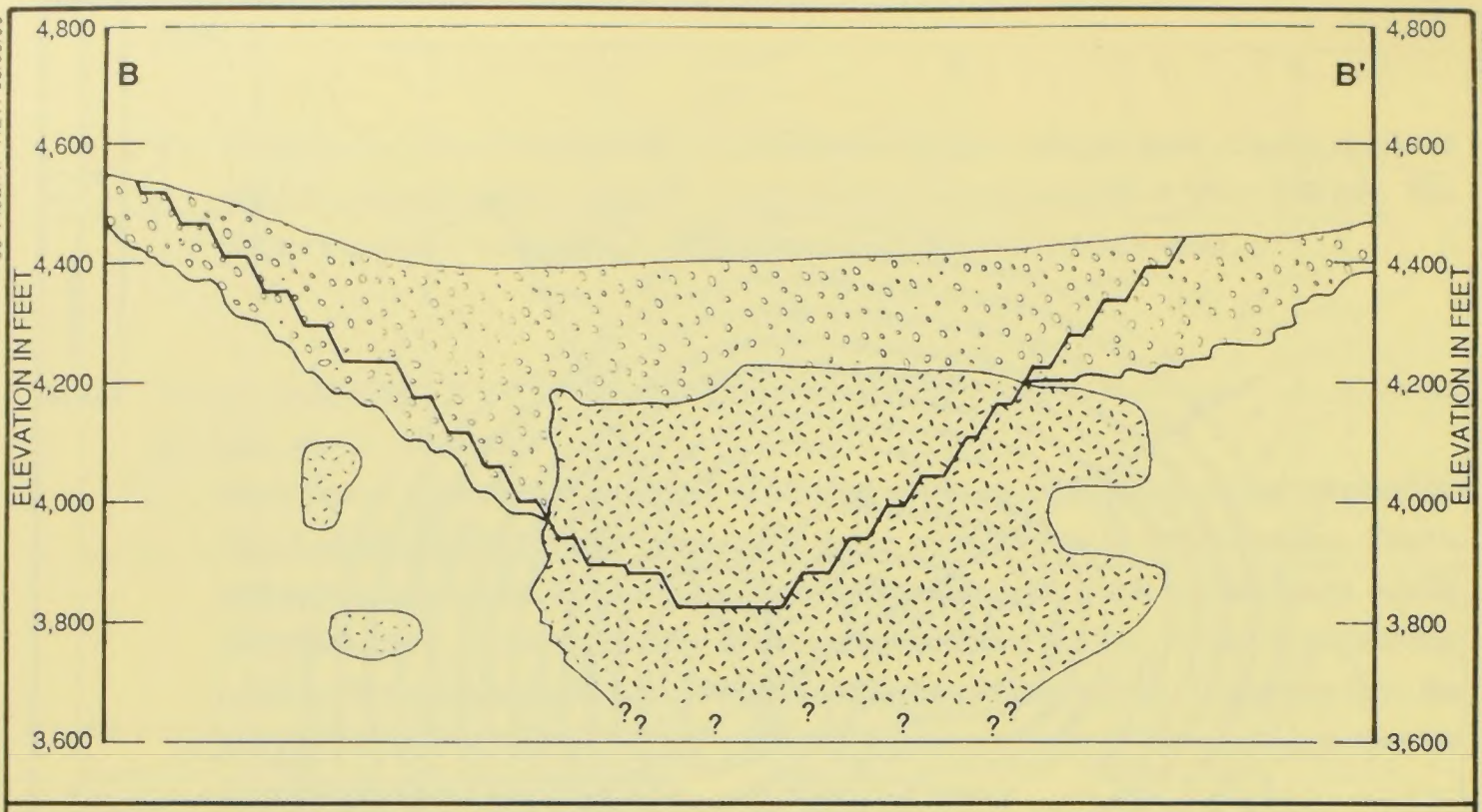
FIGURE 2.3

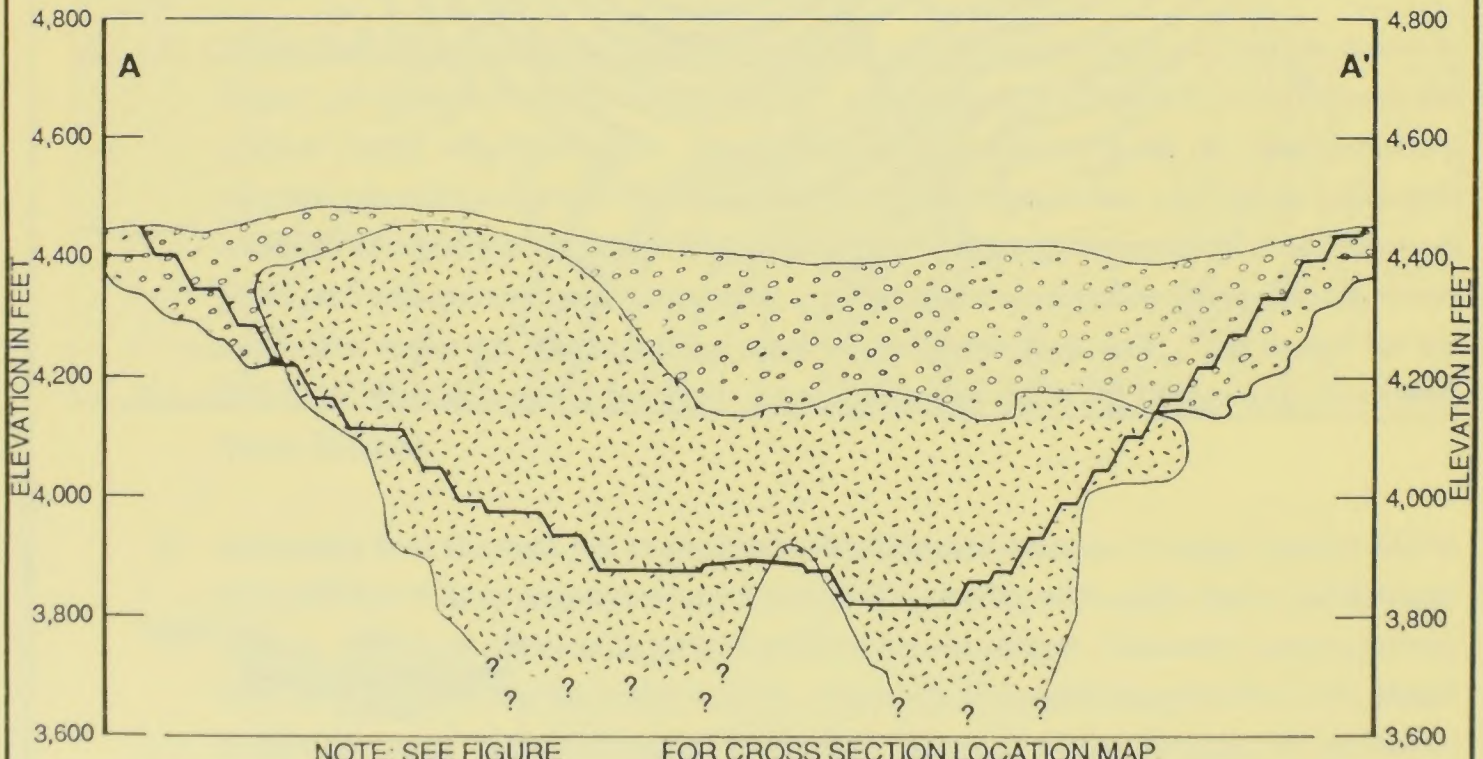
CURRENT LESLEY ANN PIT DESIGN

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

38-148B/RP REV. 05/09/90





NOTE: SEE FIGURE FOR CROSS SECTION LOCATION MAP.

0 300 600

SCALE IN FEET

LEGEND

PLANNED PIT BOUNDARY

UNMINERALIZED OVERBURDEN

DISSEMINATED GOLD MINERALIZATION

SOURCE: FIGURE 3.4.2 BY VICEROY GOLD CORPORATION.

FIGURE 2.4

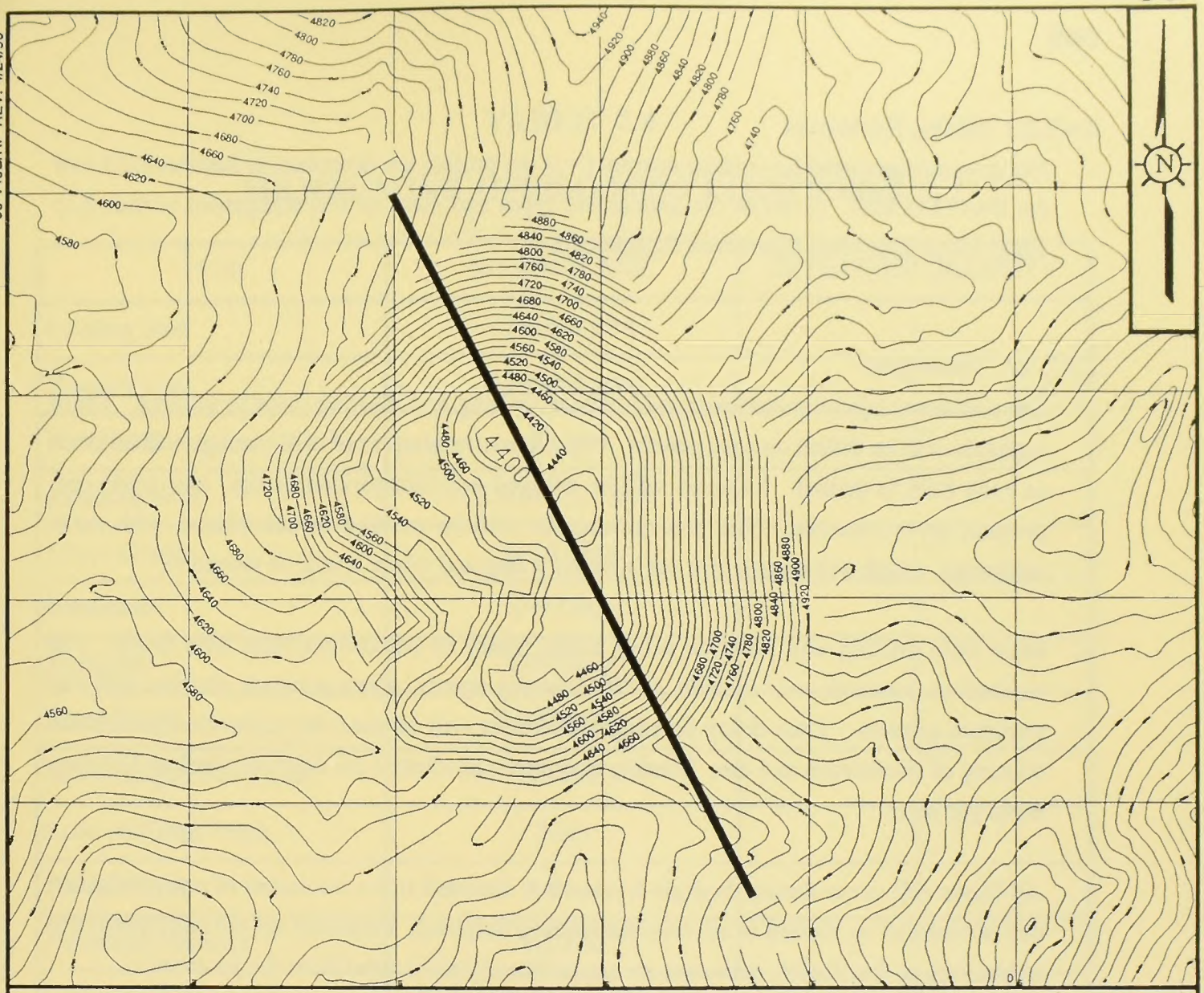
CROSS SECTIONS THROUGH THE CURRENT LESLEY ANN PIT DESIGN

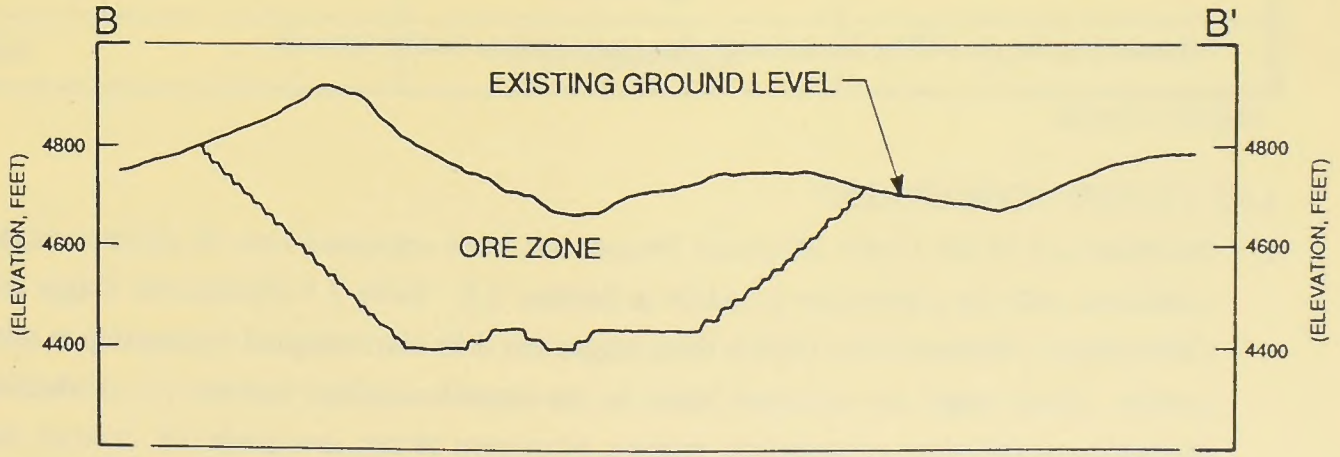
CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

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88-148B/RP REV. 4/24/90





0 300 600 FEET

FIGURE 2.5

CURRENT ORO BELLE PIT DESIGN AND ASSOCIATED CROSS SECTION

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

2.4.2.2.2 Mining Equipment

1. Major equipment used for mining operations at the project are described in Section 3.2.5.4 of the Draft EIS/EIR. A list of the anticipated types and sizes of that equipment is shown in Table 2.4 (Major Mine Operations Equipment).

2.4.2.2.3 Procedures

1. Ore and consolidated overburden will require drilling and blasting prior to loading. These materials will be drilled on a set pattern. Representative samples of drill cuttings will be taken as each hole is drilled. Samples will be assayed and categorized as ore, low grade ore, protore, or overburden. The blasted material will be marked in accordance with these categories, which will dictate how the material is dug and where it will be moved to.

2. Blast hole drilling will be done using either rotary or percussion blast hole drills. The explosives materials will include ANFO blasting agents, water resistant slurries, and cap sensitive primers. Time-delay blasting procedures will be used for controlled production blasting of overburden and ore. Blasting may occur as often as six days per week at 180 blast holes per blast.

3. All blasts will occur during daylight hours. It is intended that a minimum of one production day of material be blasted in advance for loading purposes. Problems are not anticipated due to blasting, as the closest residences are approximately eight miles from the pit areas.

4. Materials in the pit will be loaded with front-end loaders and/or shovels.

2.4.3 STAGED DEVELOPMENT

1. Development of the Castle Mountain Project has been separated into 10 distinct stages, consistent with the production schedule in Section 2.3. Table 2.5 (Production Stages and Chronological Relationships) depicts these stages and their chronological relationship to mine startup. These stages are separated based on the interrelationships between pre-production development and plant construction, mining, placement of ore, low grade ore, protore, and overburden, and reclamation efforts. Acreages disturbed are shown in Table 2.6 (Incremental Acreage Disturbed by Stage). Section 1.6 of this document describes how reclamation activities will be integrated with mining operations.

TABLE 2.4

MAJOR MINE OPERATIONS EQUIPMENT

TYPE	NOMINAL SIZE	ESTIMATED QUANTITY
Loading Unit	13-cubic yard	4
Loading Unit	6.5-cubic yard	1
Haul Truck	85 ton	12
Blasthole Drill	5.5-to 6.75-inch	4
Motor Grader	G-16 Class	1
Bulldozer	D-9 Class	2
Bulldozer	D-8 Class	1
Water Truck	8,000 gallon	2
ANFO Explosives Truck	10-ton	1
Lube and Tool Truck	3-ton	3
Pickup Truck	3/4 ton	17
Passenger Vehicles	1/2 Ton	5
Passenger Van	12-passenger	7
Bus	36 to 40 passenger	2

88-148B (7/23/90)

TABLE 2.5

PRODUCTION STAGES AND CHRONOLOGICAL RELATIONSHIPS (Months)

STAGES	START	END
Stage 1[1]	0	7
Stage 2	7	19
Stage 3	19	31
Stage 4	31	43
Stage 5	43	Lesley Ann Pit completed
Stage 6	--	Oro Belle Pit completed
Stage 7	--	Jumbo Pit and protore stockpiles completed
Stage 8	--	Leaching activities completed
Stage 9	--	Last leach pad decommissioned
Stage 10[2]	--	Reclamation procedures completed

88-148B (7/25/90)

Note:

(1) Stage 1 starts after receipt of the BLM's Record of Decision respecting the Plan of Operations for the Castle Mountain Project, and the County's approval of the Mining/Reclamation Plan application.

(2) Stage 10 involves revegetation activities in areas where buildings and equipment have been dismantled and removed following project decommissioning (see Section 1.8, Decommissioning of Facilities). Stage 10 will commence within six months after project decommissioning, and will end after the fifth growing season following the initial plantings on the areas involved in project decommissioning.

TABLE 2.6

INCREMENTAL ACREAGE DISTURBED BY STAGE
(Acres)

AREA DISTURBED	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5	STAGE 6	STAGE 7	STAGE 8	STAGE 9	STAGE 10	TOTAL
Lesley Ann Pit	71	0	19	0	0	10	–	–	–	–	100
Oro Belle Pit	–	–	–	–	35	–	–	–	–	–	35
South Clay Pit Reclamation Area	–	–	–	–	–	–	–	–	–	–	–
South Overburden Pile	77	77	40	15	30	30	31	–	–	–	300
Heap Leach Pads	44	18	26	53	63	63	63	–	–	–	330
Solution Storage	5	–	–	–	–	5	–	–	–	–	10
Crusher Area	10	–	–	–	–	–	–	–	–	–	10
Plant	4	–	–	–	–	–	–	–	–	–	4
Administration	1	–	–	–	–	–	–	–	–	–	1
Roads	17	–	–	–	8	5	–	–	–	–	30
Soil Storage	15	5	7	10	11	11	11	–	–	–	70
Stage Subtotal	244	100	92	78	147	124	105	0	0	0	
Cumulative	244	344	436	514	661	785	890	890	890	890	

88-148B (7/26/90)

2. A detailed description of the mining plan by stage is given below. This description is based on the current operational plan. Mining is a dynamic process and must be responsive to changes in economics and geotechnical factors. As with most major projects, changes will occur throughout the construction and operational phases of this project.

2.4.3.1 Stage 1

2.4.3.1.1 General Description

1. This stage starts after the permits needed to initiate the project have been received, and it continues for approximately seven months. The end of this stage is defined by the commissioning of the Primary Crusher. Overburden material will be removed from the Lesley Ann Pit and placed in the South Overburden Pile and South Clay Pit Reclamation Area. Ore material encountered during Stage 1 will be stockpiled on top of the South Overburden Pile. During this stage, the Crushing Plant, Overland Conveyor, Mining Contractor's Shop, Process Plant, Administration, and Leach Pad Areas will be cleared and graded. Construction of facilities is scheduled for completion by the end of Stage 1. The project site at the end of Stage 1 is depicted in Figure 2.6 (Project Status at the End of Stage 1).

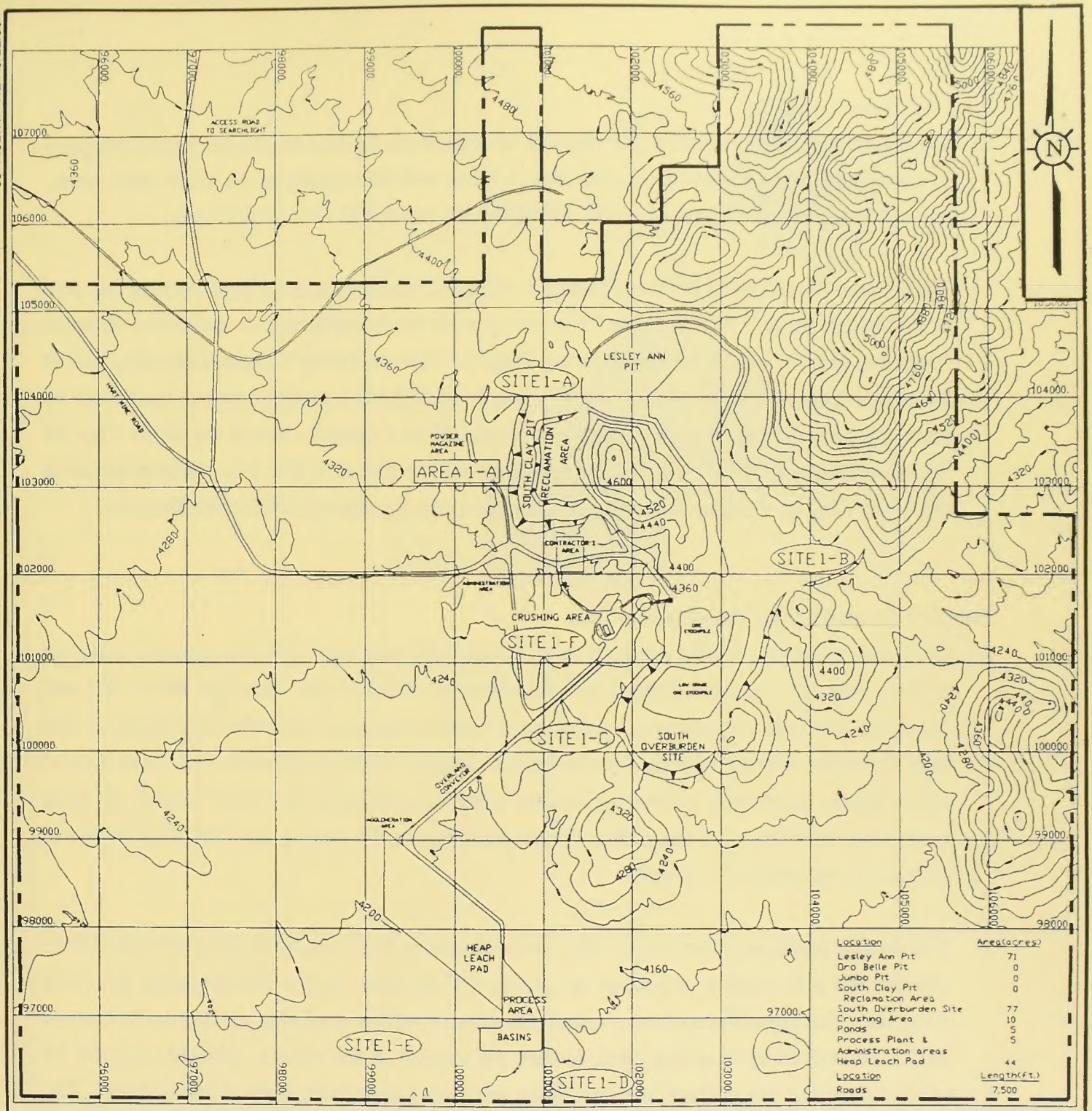
2. For planning purposes, the quantity of salvageable growth material was estimated, based upon the findings of the soil survey described in Section 4.2.4. Volumes of growth media to be salvaged during each stage were estimated by overlaying the soil map shown in Figure 2.6, on staged development plans for the project.

3. The experimental garden and nursery, initial test plots, and field trials discussed in the Revegetation Research Program (see Section 1.4) will be located during this stage next to the Administration building and near growth media storage areas such as: Site 1-A, 1-D, 1-E, and 1-F.

4. Fencing will be erected around the project site during Stage 1.

5. Road Segment A of the Mitigated Access Route will, to the extent possible, use the existing alignment of the Walking Box Ranch water pipeline maintenance road for access to the State Route 164.

88-148B/RP REV 5/22/90



Location	Area(acres)
Lesley Ann Pit	71
Dro Belle Pit	0
Jumbo Pit	0
South Clay Pit Reclamation Area	0
South Overburden Site	77
Crushing Area	10
Ponds	5
Process Plant & Administration areas	5
Heap Leach Pad	44

Location	Length(ft.)
Roads	7,500

FIGURE 2.6

PROJECT STATUS AT THE END OF STAGE 1

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

2.4.3.1.2 Lesley Ann Pit

1. During Stage 1, pre-production mining will be done in the Lesley Ann Pit in benches ranging in elevation from 4,640 to 4,360 feet. Bench faces will be exposed in the north, east, south, and west walls at elevations of 4,600, 4,640, 4,540, and 4,400 feet, respectively.

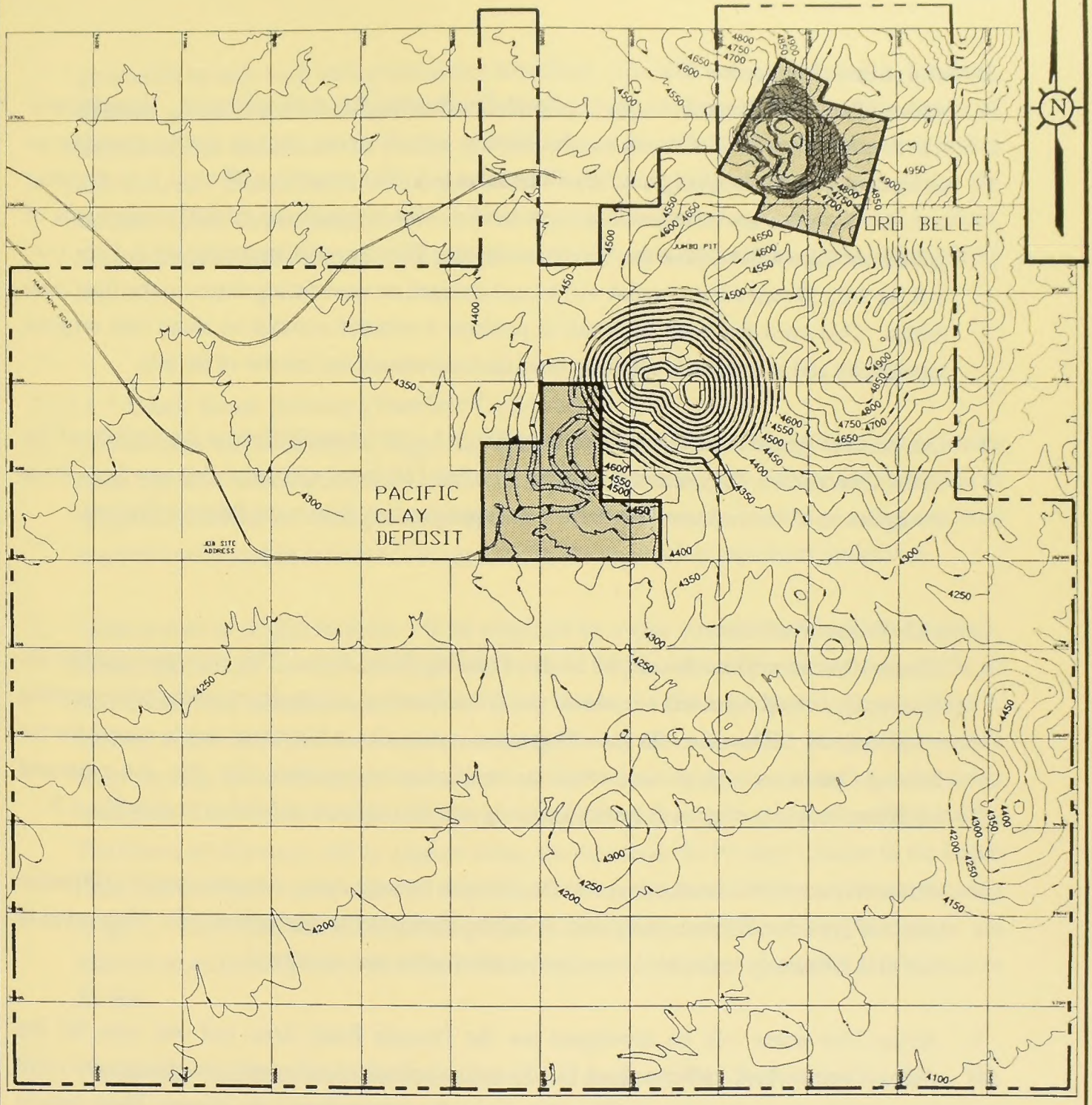
2. The pit area developed at the end of Stage 1 will cover about 71 acres. Vegetation in this area is blackbush scrub. Within these 71 acres, growth media covering an estimated 59 acres (mapping unit 3), will be salvaged during Stage 1. The remaining 12 acres (mapping unit 4) has no salvageable growth media. Approximately 63,500 cubic yards of growth media will be removed from the pit area. A portion will be placed on prepared areas in the South Clay Pit Reclamation Area (Area 1-A), and the remainder will be placed at Site 1-A. Growth media in the South Clay Pit Reclamation Area will be used in the Revegetation Research Program.

2.4.3.1.3 South Clay Pit Reclamation Area

1. This area is largely within patented land, which has been used over the past 60 years for mining clay, as shown in Figure 2.7 (Location of Pacific Clay and Oro Belle Patented Claims). Evidence of past clay quarrying is readily apparent, since the disturbed soil and rock are lighter in color than the surrounding landscape. Initial reclamation will cover most of these lighter areas with darker overburden material, reducing the visual impact of those quarrying activities. During Stage 1 overburden from the Lesley Ann Pit will be placed around the perimeter of this area.

2. The outside perimeter of the South Clay Pit Reclamation Area will be developed to provide an overburden pile surface, a portion of which will be used for the Revegetation Research Program. The top surface of the overburden material will be graded at an approximate slope of 0.5 percent away from the crest, toward the interior of the quarry. Should sediment be eroded from the top surface, the backslope will serve to contain it within the quarry. The effectiveness of this erosion control measure will be monitored in order to refine subsequent stockpile designs. Traffic related to mining activities will remain relatively high across this area, limiting ground preparation and revegetation studies to a portion of the upper surface of this area during Stage 1.

88-148B/RP REV. 4/24/90



0 1200 2400 FEET
SCALE

LEGEND

PATENTED CLAIMS

FIGURE 2.7

LOCATION OF PACIFIC CLAY AND ORO BELLE PATENTED CLAIMS

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

2.4.3.1.4 South Overburden Pile

1. About 77 acres will be covered by the South Overburden Pile during Stage 1. Vegetation in this area consists of blackbush scrub. Within this 77 acres, growth media covering an estimated 55 acres (mapping unit 3) will be salvaged. The remaining 22 acres is in mapping unit 4, which has no salvageable growth media. The approximate 61,300 cubic yards of growth media removed from the South Overburden Pile area will be stockpiled at Sites 1-A, 1-B, or 1-C. Overburden material will be end dumped on west-facing slopes to the final crest limits. This crest has been designed to produce a rounded contour to blend into original topography and to direct run-off away from the crest toward the interior of the pile.

2. Ore and low grade material mined during Stage 1 will be stockpiled on the surface of the South Overburden Pile, near the Primary Crusher. Material will be withdrawn from these stockpiles on an intermittent basis for use as supplementary feed to the Primary Crusher.

2.4.3.1.5 Project Facilities

1. About 10 acres will be developed in the Crushing Plant Area. This acreage includes the Contractor's Shop Area and a laydown site for offloading and storing construction materials when they are delivered to the site. Vegetation in this area is blackbush scrub, except for the Mining Contractor's Shop Area which is classified as unvegetated clay pits. An estimated 10,800 cubic yards of growth media (mapping unit 3) will be stockpiled at nearby Site 1-F.

2. About five acres will be developed in the Solution Storage Area. An estimated 12,100 cubic yards of growth media (mapping unit 1) will be stockpiled at nearby Site 1-D. Vegetation in this area is desert grassland/creosote bush scrub/Joshua tree woodland.

3. About four acres will be developed for the Process Plant Area and one acre for the Administration Area. An estimated 12,100 cubic yards of growth media (mapping unit 1) will be stockpiled at nearby Site 1-D, 1-E, and/or 1-F. Vegetation in the Process Plant Area is desert grassland/creosote bush scrub/Joshua tree woodland, while the Administration Area is Joshua tree woodland.

2.4.3.1.6 Heap Leach Pad Area

1. About 44 acres will be developed for the Heap Leach Pad Area during Stage 1. Ore bearing material will be not placed on the pads during Stage 1. Vegetation in this area is desert

grassland/creosote bush scrub/Joshua tree woodland. The area is mapped as unit 1, however, detailed geotechnical investigation for leach pad design indicated very shallow depths of unconsolidated material in this portion of the leach pad area. Bedrock exposures occur within this area, and four of ten test pits encountered caliche or bedrock immediately below the surface. Based on this data, it is estimated that growth media averages eight inches in depth. An estimated 47,300 cubic yards of growth media to be salvaged will be stockpiled at nearby Site 1-E.

2.4.3.1.7 Onsite Roads (including Overland Conveyor)

1. Onsite roads will connect the major facilities as shown in Figure 2.6. Alignment of onsite roads has been selected to follow existing topographic contours as closely as practicable to minimize disturbance. Changes made to the proposed alignments in order to suit operational requirements would be submitted for approval by the appropriate regulatory authorities.

2. Public access to project facilities will be restricted by a gate west of the Administration Area. Roads intended for use by haul trucks will be about 60 feet wide to permit two-way traffic of haul trucks, plus an additional 15 feet for safety berms and drainage ditches. During Stage 1, the only haul road in place will run between the Primary Crusher and the Mining Contractor's Shop facility, since the other haul routes will be within the pit or on top of overburden stockpiles. Other roads will generally be about 25 feet wide to accommodate two-way traffic. The Overland Conveyor will be aligned within the road from the Primary Crusher to the Leach Pads, and this road will be about 35 feet wide. Most onsite roads will be constructed during Stage 1. The Administration, Mining Contractor's Shop, and Crushing Plant areas are adjacent to an existing road. This road will be widened from its present width (15-16 feet) to 25 feet.

3. The Powder Magazine Area will be located west of the South Clay Pit Reclamation Area. The road to this area will be built for two-way traffic. The end of this road will be widened to about 75 feet. All of the facilities for storing explosives will be placed along the widened section of road.

4. Onsite road construction will involve grading surface material. All roads will be maintained in a satisfactory condition to provide appropriate access for project operations. Dust control measures will include regular spraying with water. Frequency of spraying will depend on traffic volume, climatological conditions, and ambient wind speeds.

5. Onsite roads cross four different plant communities. Table 2.7 (Stage 1 - Onsite Road Lengths) itemizes the distance of onsite roads that will be within these plant communities. Approximately 17 acres of land will be affected by road construction/improvements.

2.4.3.2 Stage 2

2.4.3.2.1 General Description

1. This stage starts immediately after Stage 1 and lasts for 12 months (see Figure 2.8, Project Status at the End of Stage 2). During Stage 2, overburden material will be removed from the Lesley Ann Pit and placed in the South Overburden Pile. Approximately three million tons of ore material will be crushed and placed on the Heap Leach Pad. Low grade material will be stockpiled on the South Overburden Pile, adjacent to the Primary Crusher.

2.4.3.2.2 Lesley Ann Pit

1. The surface area developed at the Lesley Ann Pit does not increase during Stage 2, since the mined material is from within the existing pit, with no expansion of the perimeter. At the end of Stage 2, it is estimated that the pit will have been developed down to an elevation of 4,180 feet.

2.4.3.2.3 South Clay Pit Reclamation Area

1. Overburden material will not be moved to the South Clay Pit Reclamation Area during Stage 2. The Revegetation Research Program initiated in this area during Stage 1 will continue (Area 2-A).

2.4.3.2.4 South Overburden Pile

1. The South Overburden Pile will increase in size, covering an additional 77 acres at the end of Stage 2. This area contains two plant communities: about 30 acres of Joshua tree woodland and about 47 acres of blackbush scrub. Within the 77 acres, approximately 53,800 cubic yards of growth media will be salvaged from an estimated 50 acres (mapping unit 3). This growth media will be placed at Sites 2-A, 2-B, or 2-C.

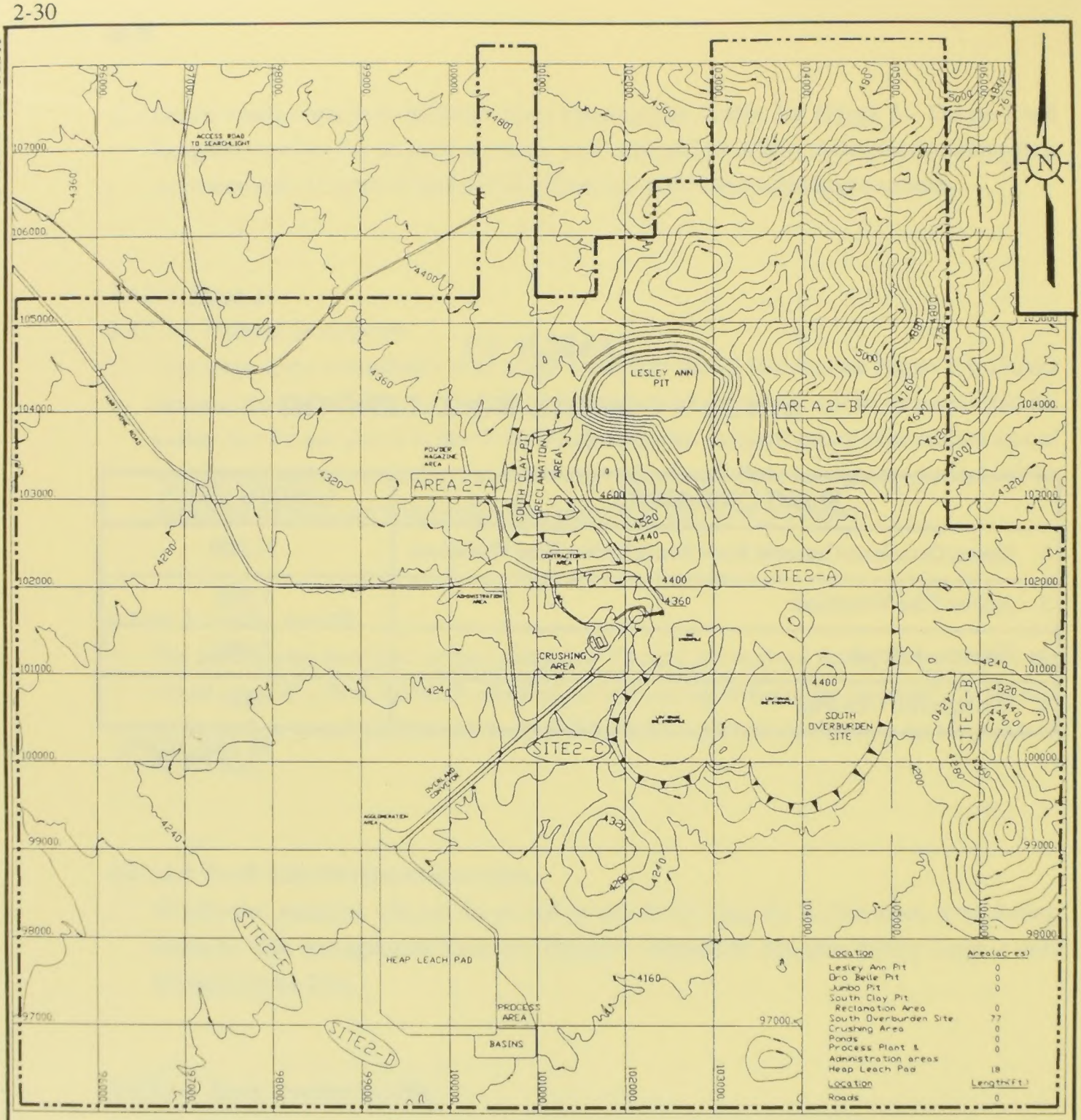
TABLE 2.7

STAGE 1 - ONSITE ROAD LENGTHS

PLANT COMMUNITY	LENGTH (FEET)
1. Desert Grassland/Creosote Bush Scrub/Joshua Tree Woodland	11,800
2. Joshua Tree Woodland	7,500
3. Blackbush Scrub	5,000
4. Unvegetated Clay Pits	800

88-148B (7/23/90)

88-148B/RP REV 5/22/90



0 1200 2400 FEET

SCALE

FIGURE 2.8

PROJECT STATUS AT THE END OF STAGE 2

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

2.4.3.2.5 Project Facilities

1. No additional construction of Project Facilities is expected to occur during Stage 2.

2.4.3.2.6 Heap Leach Pad Area

1. About 18 acres of additional heap leach pad area will be developed during Stage 2, based on current estimated operational requirements. Vegetation in this area is desert grassland/creosote bush scrub/Joshua tree woodland. Test pit refusal where equipment could no longer break ground, occurred immediately below the surface and scattered bedrock exposures indicate shallow depths of growth media over most of this area. An estimated eight inches average depth will provide approximately 19,300 cubic yards of growth media, which will be stockpiled at nearby Sites 2-D and 2-E.

2. Approximately three million tons of ore bearing material will have been placed on the pads by the end of Stage 2. This material will be placed in one 20-foot lift.

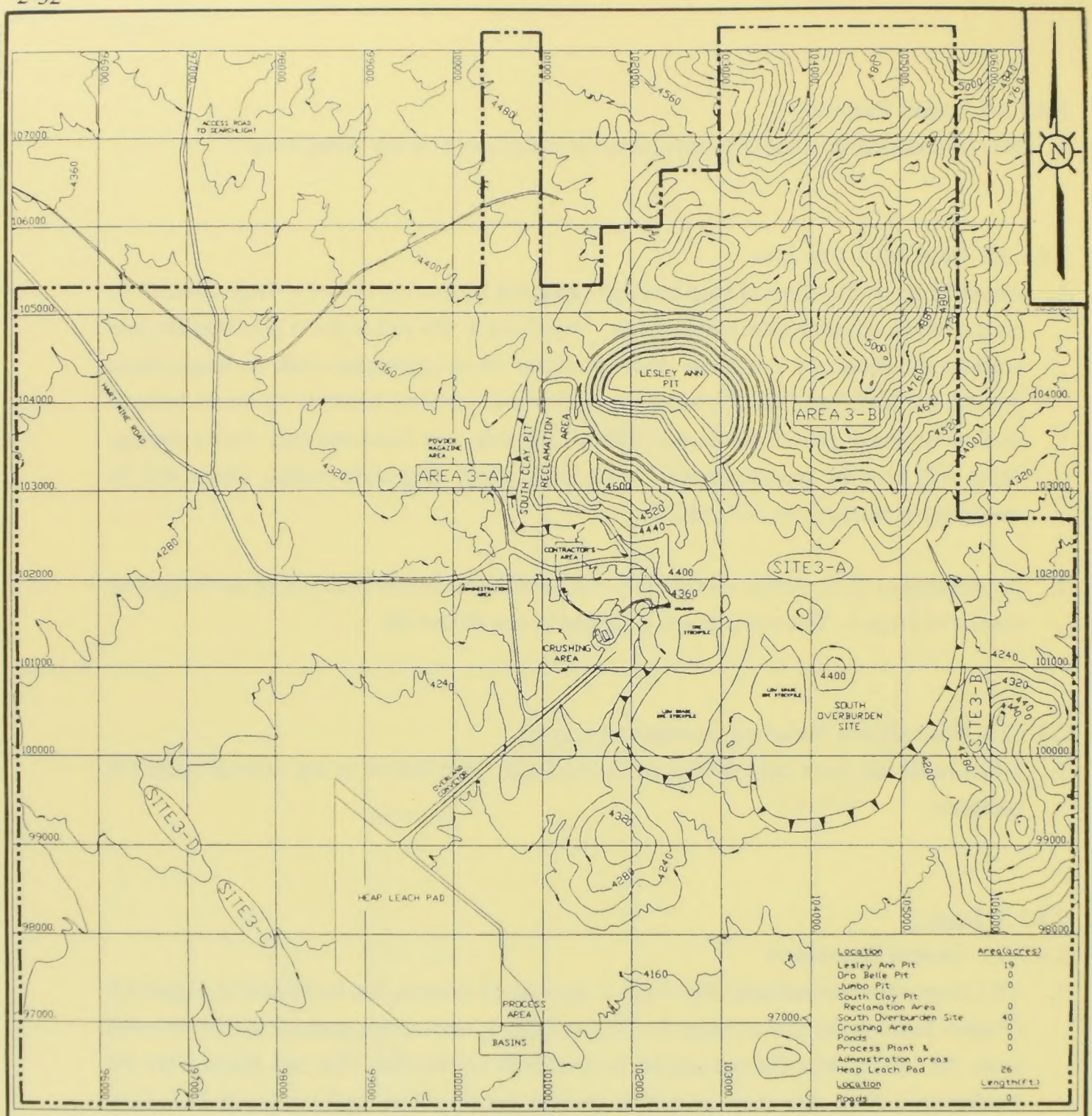
2.4.3.2.7 Onsite Roads (including Overland Conveyor)

1. Major roads will have been developed during Stage 1 and will be in use until the project is complete.

2.4.3.3 Stage 3

2.4.3.3.1 General Description

1. This stage starts immediately after Stage 2, lasts for 12 months, and is depicted in Figure 2.9 (Project Status at the End of Stage 3). During Stage 3, overburden material will be removed from the Lesley Ann Pit and placed in the South Overburden Pile and South Clay Pit Reclamation Area. Ore material will be crushed and placed on the Heap Leach Pad. Low grade material will be stockpiled on overburden within the South Overburden Pile, adjacent to the Primary Crusher.



0 1200 2400 FEET

SCALE

FIGURE 2.9

PROJECT STATUS AT THE END OF STAGE 3

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

2.4.3.3.2 Lesley Ann Pit

1. The Lesley Ann Pit will be developed to its anticipated ultimate pit perimeter during Stage 3, resulting in an additional 19 acres of newly developed land. Vegetation in this area is blackbush scrub. Within the 19 acres, approximately 11,800 cubic yards of growth media will be salvaged from an estimated 11 acres (mapping unit 3) and placed at Site 3-A.

2. Bench faces will be developed on the north, east, and southwest sides of the pit, to elevations of 4,600, 4,640, and 4,620 feet, respectively. Mining will be conducted down to 4,080 feet. Overburden material removed from the southwestern pit highwall will be placed in the South Clay Pit Reclamation Area, while overburden material from other portions of the pit will be placed in the South Overburden Pile.

2.4.3.3.3 South Clay Pit Reclamation Area

1. Overburden material placed during Stage 1 will have formed the outside perimeter of the initial terrace within the South Clay Pit Reclamation Area. Material placed during Stage 3 will be placed above and behind this perimeter (i.e., to the east) in three additional terraces. The final South Clay Pit Reclamation Area will cover about 36 acres.

2. Drainage will be established with grading to minimize erosion. The upper surface of each terrace will be graded at a slope ranging from of 0.5 percent to 1.0 percent toward the toe of the terrace above. The top terrace will be graded toward the east.

2.4.3.3.4 South Overburden Pile

1. The South Overburden Pile will expand to cover an additional 40 acres during Stage 3. Two plant communities occur within this 40 acres, consisting of about 32 acres of Joshua tree woodland and about eight acres of blackbush scrub. Approximately 43,000 cubic yards of growth media will be salvaged from this area (mapping unit 3) and will be stockpiled at Sites 3-A or 3-B.

2.4.3.3.5 Project Facilities

1. Additional construction of these facilities is not expected to occur during Stage 3.

2.4.3.3.6 Heap Leach Pad Area

1. About 26 acres of additional Heap Leach Pad Area will be developed during Stage 3. This amount of development is based on current estimated operational requirements and may change. Vegetation of this area is desert grassland/creosote bush scrub/Joshua tree woodland. Approximately 41,900 cubic yards of growth media will be salvaged from this area (mapping unit 1), and will be stockpiled at nearby Sites 3-C and 3-D. Field data indicates growth media depth in the southwest portion of this development level will provide limited quantities of growth media. An estimated average depth of 12 inches was assumed.

2. Approximately three million tons of ore bearing material will be placed on the pads during Stage 3. This material will be placed in an initial 20-foot high lift on a prepared base or as a second lift on top of previously placed ore material.

2.4.3.3.7 Onsite Roads (including Overland Conveyor)

1. Major roads will have been developed during Stage 1.

2.4.3.4 Stage 4

2.4.3.4.1 General Description

1. This stage starts immediately after Stage 3 and lasts for 12 months (see Figure 2.10, Project Status at the End of Stage 4). During Stage 4, overburden material will overburden material will be removed from the Lesley Ann Pit and placed in the South Overburden Pile. Ore material will be crushed and placed on the Heap Leach Pad. Low grade material will be stockpiled on overburden within the South Overburden Pile, adjacent to the Primary Crusher.

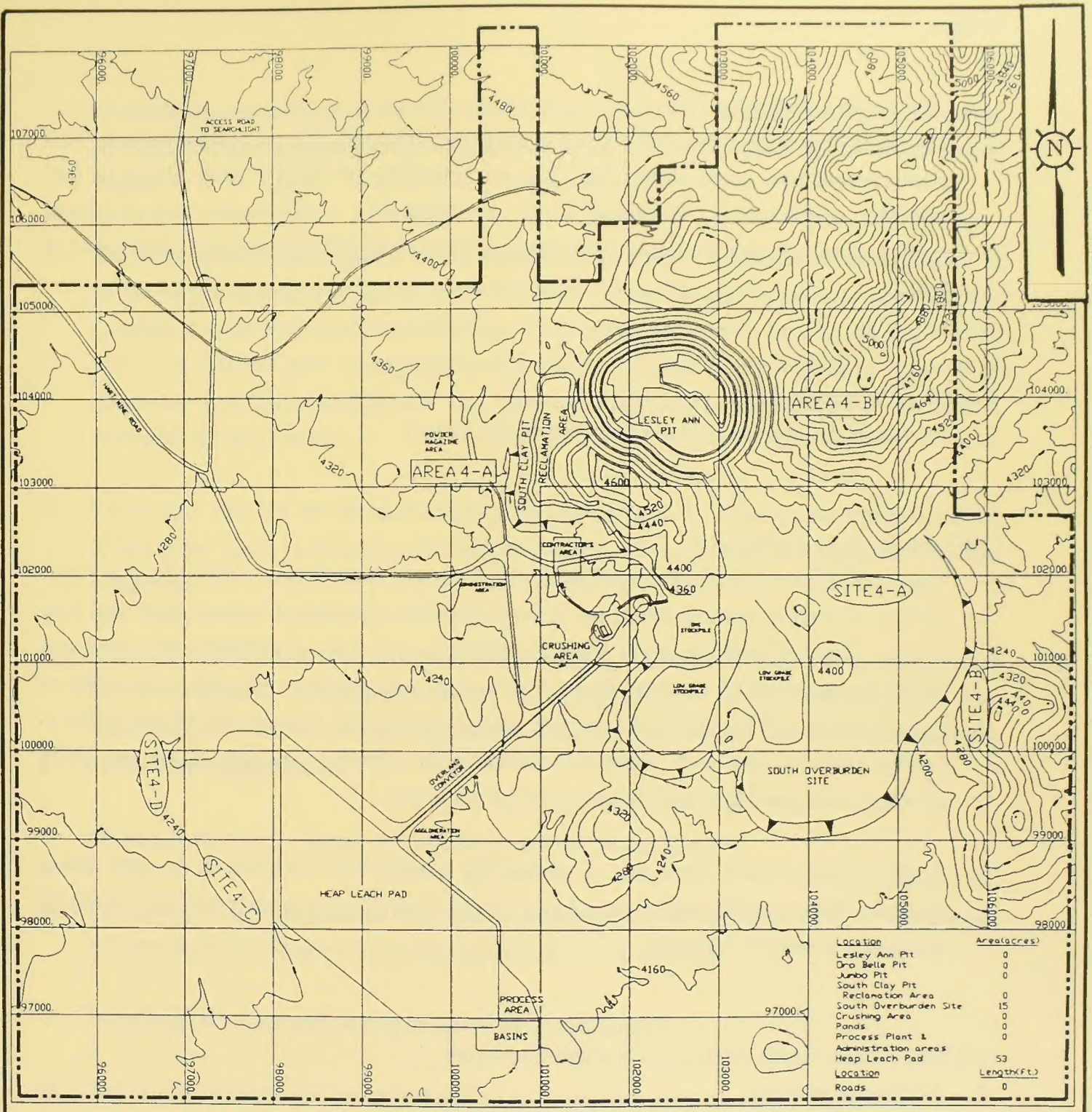
2.4.3.4.2 Lesley Ann Pit

1. The surface area developed within the Lesley Ann Pit does not increase, since the extracted material is from within the existing pit limits. At the end of Stage 4, it is estimated that the pit will be developed down to an elevation of 4,040 feet.

2.4.3.4.3 South Clay Pit Reclamation Area

1. Additional development will not occur in this area during Stage 4.

88-148B/RP REV 5/22/90



0 1200 2400 FEET

SCALE

FIGURE 2.10

PROJECT STATUS AT THE END OF STAGE 4

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

2.4.3.4.4 South Overburden Pile

1. The South Overburden Pile will expand to cover an additional 15 acres during Stage 4. Two plant communities occur within this 15 acres, consisting of about 7 acres of Joshua tree woodland and 8 acres of blackbush scrub. Approximately 16,100 cubic yards of growth media will be salvaged from this area (mapping unit 3) and will be stockpiled at Sites 4-A or 4-B.

2.4.3.4.5 Project Facilities

1. Additional development is not anticipated during Stage 4.

2.4.3.4.6 Heap Leach Pad Area

1. About 53 acres of additional Heap Leach Pad Area will be developed during Stage 4. This amount of development is based on current estimated operational requirements and may change. Vegetation of this area is desert grassland/creosote bush scrub/Joshua tree woodland. Based on an estimated average depth of 18 inches, approximately 128,200 cubic yards of growth media will be salvaged from this area (mapping unit 1), and will be stockpiled at nearby Sites 4-C and 4-D. Field data indicates the southwest portion of the area being developed will provide limited quantities of growth media.

2. Approximately three million tons of ore bearing material will be placed on the pads during Stage 4. This material will be placed in a 20-foot high lift on a prepared base or on top of previously placed ore material.

2.4.3.4.7 Onsite Roads (including Overland Conveyor)

1. No change in status.

2.4.3.5 Stage 5 Through Stage 9

2.4.3.5.1 General Description

1. These stages start immediately after Stage 4 and continue until the last Heap Leach Pad has been decommissioned. During this period remaining ore material from the mine pits will be

removed, placed on Heap Leach Pads and leached. Figure 2.11 (Preliminary Project Status at the End of Stage 9) illustrates the topography of the Castle Mountain Project at the end of Stage 9.

2. While the general development of the project during Stages 5 through 9 will be similar to earlier stages, the engineering for the Oro Belle Pit, Jumbo Pit, and future Heap Leach Pads is conceptual rather than detailed at this time. The information needed for detailed engineering will be completed prior to beginning each stage. This will allow regulatory agencies to determine regulatory compliance and arrive at appropriate adjustments to the annual reclamation bond amount.

3. The Lesley Ann Pit will be completed by the end of Stage 5. Overburden material will be placed in the South Overburden Pile, and ore material will be crushed and placed on the Heap Leach Pad.

4. Mining in the Oro Belle Pit will commence in Stage 5. Mining in this pit will be completed at the end of Stage 6. Overburden material will be placed in the South Overburden Pile. The second Heap Leach Pad will be constructed to take ore from the Oro Belle Pit which has been crushed and agglomerated.

5. Mining of the Jumbo deposit will also be completed during Stage 7.

6. Processing of protore material will also be completed by the end of Stage 7. This material will be crushed and placed on the second or third heap leach pad.

7. Heap leach activities will be completed by the end of Stage 8.

8. The last Heap Leach Pad developed will be decommissioned by the end of Stage 9.

2.4.3.5.2 Open Pit Mining Activities

1. By the end of Stage 5, the Lesley Ann Pit will have been developed down to an elevation of 3,800 feet, the presently anticipated lowest elevation in the pit. Overburden material will be placed in the South Overburden Pile, and ore material will be crushed and placed on the Heap Leach Pad.

88-148B/RP REV.5/22/90

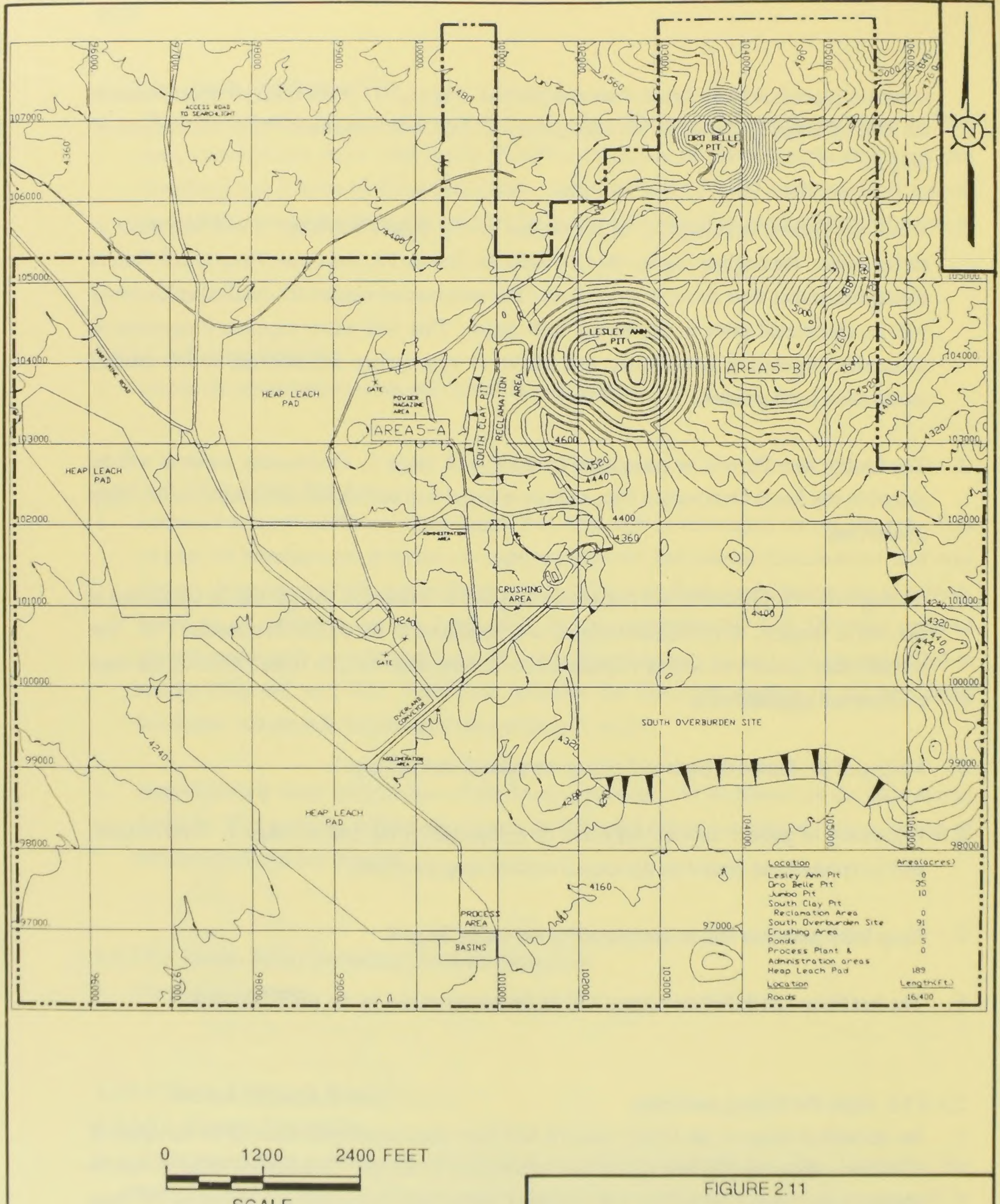


FIGURE 2.11

PRELIMINARY PROJECT STATUS AT THE END OF STAGE 9

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

2. During Stage 5, prior to the date mining is completed in the Lesley Ann Pit, production will commence from the Oro Belle Pit. Ore will be hauled to the Primary Crusher, crushed, and placed on the Heap Leach Pad. Overburden will be hauled to the South Overburden Pile. It is presently expected that the Oro Belle Pit will be developed down to an elevation of 4,400 feet. Additional drilling will be needed before a final pit design can be completed. Soil survey results indicate that no recoverable growth media exists in the Oro Belle Pit area.

3. The Jumbo deposit has not been drilled sufficiently to establish a definitive pit design. However, it is expected that the pit created when this deposit is mined will have a configuration generally as shown in Figure 2.11. Depending upon results from additional drilling, it is possible the Jumbo deposit could be scheduled to precede, rather than follow, development of the Oro Belle Pit.

4. The current Jumbo Pit configuration encompasses an area of approximately 10 acres. Approximately 4,300 cubic yards of growth media will be salvaged from an estimated four acres (mapping unit 3) when this site is being prepared for mining.

2.4.3.5.3 South Clay Pit Reclamation Area

1. No additional development will occur in this area during Stages 5 through 9.

2.4.3.5.4 South Overburden Pile

1. By the start of Stage 5, the South Overburden Pile will have been developed to approximately two-thirds of its ultimate size. An additional 91 acres will be developed during Stages 5 through 9. Two plant communities occur within this 91 acres: about 42 acres of Joshua tree woodland and the 49 acres of blackbush scrub. Within this 91 acres, approximately 21,500 cubic yards of growth media will be salvaged from an estimated 20 acres (mapping unit 3).

2.4.3.5.5 Project Facilities

1. Except as noted, expansion of these facilities is not anticipated during Stages 5 through 9.

2. Additional solution storage area will have to be developed at the south end of the second Heap Leach Pad during Stage 5. It would contain storage tanks for pregnant and intermediate leach solutions, and an emergency solution storage basin. The design of this storage area will be

subject to review and approval by the RWQCB. This area will develop about another five acres (mapping unit 1 of the soils inventory found in Appendix E) of land within Joshua tree woodland. Approximately 12,100 cubic yards of growth media will be removed and stockpiled nearby.

2.4.3.5.6 Heap Leach Pad Area

1. Ore material, at an annual rate of about three million tons, will continue to be placed on the initial Heap Leach Pad until the pad has been developed to its ultimate height. It is expected that this height will be about 80 feet, but depending on the ability of leach solutions to percolate through the heaped ore material, it could be higher. When the initial Heap Leach Pad has been loaded to its ultimate height, ore material will be placed on a second Heap Leach Pad, to be constructed north of the initial Heap Leach Pad.

2. It is estimated that the initial Heap Leach Pad will be completed at the end of Stage 5. The second Heap Leach Pad will be completed in Stage 6. If additional pad space is required, a third pad will be constructed during Stage 7.

3. The general arrangement and conceptual layout of the second and third Heap Leach Pads will be similar to the initial Heap Leach Pad. Definitive engineering on the development of these two pads will be deferred for several years. Final engineering design to accommodate site-specific conditions could result in some modification to the shape and orientation of the pads from that shown. The detailed engineering design of these two pads will be submitted for review and approval by the RWQCB.

4. The second and third Heap Leach Pads may cover an additional 189 acres by the end of Stage 7. About 87 of the 189 acres occurs within Joshua tree woodland, with the remainder within desert grassland/creosote bush scrub/Joshua tree woodland. Approximately 400,000 cubic yards of growth media (mapping units 1 and 3) encountered during the development of these two pads will be stockpiled nearby.

2.4.3.5.7 Onsite Roads (including Overland Conveyor)

1. Depending on the ultimate size and configuration of the northeastern leach pad, the main access route may have to be re-routed in the form of a "U" around the south end of the leach pad.

2. The overland conveyor will be realigned to a more westerly course from the Crushing Plant Area to supply ore to the second leach pad at the end of Stage 5. The conveyor will be contained within a road which is estimated to be about 35 feet wide.

3. Additional onsite roads built during Stages 5 through 7 will cross the plant communities shown in Table 2.8 (Onsite Road Lengths). This table itemizes the lengths of onsite roads both being developed and in use within these plant communities. The additional roads will be constructed in a manner similar to those described in Stage 1 and will be subject to BLM review and approval.

2.4.3.6 Stage 10

1. Stage 10 ends when reclamation activities have been completed as detailed in Sections 1.6 and 1.7. The resulting post-mining topography and hydrology are described in Sections 1.10 and 1.11, respectively.

2.4.4 MINE PRODUCT CHARACTERIZATION

1. Samples of ore, protore, and overburden have been subjected to geochemical testing to determine their acid generation potential and likelihood for solubilization of various metals. Results are summarized in Table 2.9 (Summary of Results: Analysis of Ore, Protore, and Overburden). The measured concentrations of metals commonly associated with gold ores are relatively low in relation to concentrations considered to be of potential concern by California regulatory agencies.

2. The metal concentrations shown in Table 2.9 are based on a laboratory procedure for evaluating materials to be placed in landfill sites. The procedure, required by State law, uses citric acid to intentionally leach metals from the material being evaluated, since citric acid can be generated by the decomposition of various fruit and vegetable wastes that are dumped at such sites. No such wastes will be placed in the heap leach or overburden piles at the Castle Mountain Project.

TABLE 2.8

ONSITE ROAD LENGTHS
(Feet)

PLANT COMMUNITY	INCREMENTAL	CUMULATIVE
1. Desert Grassland/Creosote Bush Scrub/Joshua Tree Woodland	1,400	20,400
2. Joshua Tree Woodland	8,000	13,000
3. Blackbush Scrub	7,000	11,800
4. Unvegetated Clay Pits	0	800

88-148B (7/26/90)

TABLE 2.9

SUMMARY OF RESULTS
ANALYSIS OF ORE, PROTORE, AND OVERBURDEN

PARAMETER	RESULTS FOR TWO SEPARATE ANALYSES[1]			RESULTS FROM OVERBURDEN SAMPLES[2] (4 SAMPLES)			RESULTS FROM SPENT ORE[3] (1 SAMPLE)	STLC[4]
	MAXIMUM VALUE	MINIMUM VALUE	AVERAGE	MAXIMUM VALUE	MINIMUM VALUE	AVERAGE		
Neutralization Potential (tons $CaCO_3$/1,000 tons of material)	105.7	2.9	54.3	161.0	5.2	59.6	7.6	*
Potential Acidity (tons $CaCO_3$/1,000 tons of material)	4.7	<0.3	2.4	<0.10	<0.10	<0.10	<0.1	*
Net Acid Base Potential (±tons $CaCO_3$/1,000 tons of material)	101.0	2.9	5.19	161.0	5.2	59.6	7.6	*
METALS (Concentrations in mg/L)								
Antimony	–	–	–	<0.2	<0.2	<0.2	<0.1	15.0
Arsenic	0.24	0.08	0.16	0.38	0.08	0.18	0.26	5.0
Barium	6.9	2.2	4.5	3.18	1.02	1.74	1.80	100.0
Beryllium	–	–	–	0.032	<0.005	0.015	<0.005	0.75
Cadmium	0.01	<0.01	<0.01	0.012	<0.005	0.007	<0.005	1.0
Chromium	0.14	0.11	0.125	0.44	0.18	0.25	0.40	5.0
Cobalt	–	–	–	0.24	<0.03	0.14	0.10	80.0
Copper	–	–	–	1.08	0.44	0.62	0.48	25.0
Lead	5.51	1.76	3.6	0.46	0.07	0.27	0.36	5.0
Mercury	0.0005	<0.0003	0.0004	<0.0006	<0.0006	<0.0006	<0.0006	0.2
Molybdenum	–	–	–	0.14	0.05	0.07	0.10	350.0
Nickel	–	–	–	0.52	0.18	0.32	0.36	20.0
Selenium	<0.10	<0.10	<0.10	<0.2	<0.2	<0.2	<0.1	1.0
Silver	0.03	0.04	0.035	<0.01	<0.01	<0.01	<0.01	5.0
Thallium	–	–	–	0.2	<0.2	0.2	<0.1	7.0
Vanadium	–	–	–	0.16	0.06	0.10	0.14	24.0
Zinc	–	–	–	0.80	0.08	0.32	0.28	250.0

(1) Samples were composited from ore, protore, and overburden.

(2) Two samples were taken from unconsolidated overburden and two from consolidated overburden.

(3) Sample of ore was subjected to a column leach test, a test used to measure heap leach success, prior to being analyzed.

(4) Soluble Threshold Limit Concentration for Hazardous Waste, Code of Regulations Title 22. Extract metals determined by Waste Extraction Test (WET) as documented in Title 22.

- Not Analyzed

* Not Applicable

88-148B (7/23/90)

3. As indicated in Table 2.9, ore and overburden materials at the Castle Mountain Project are slightly alkaline in nature and are essentially devoid of sulfides. They will not produce acid leachate conditions. Consequently, the concentration of metals leached as rainwater or snow melt percolates through these materials will be much lower than those indicated by the citric acid leach tests.

2.5 ORE PROCESSING

2.5.1 CRUSHING AND CONVEYING CIRCUIT

1. The crushing and conveying circuit will consist of primary, secondary, and tertiary crushers, vibrating screens, a crushed ore stockpile, a bypass surge stockpile, and a series of conveyors. Ore will be crushed at an annual rate of approximately 3 milion tons, stockpiled, agglomerated (as necessary), and then conveyed to the Heap Leach Pads, as shown in Figure 2.12 (Mining and Crushing Operations Diagram).

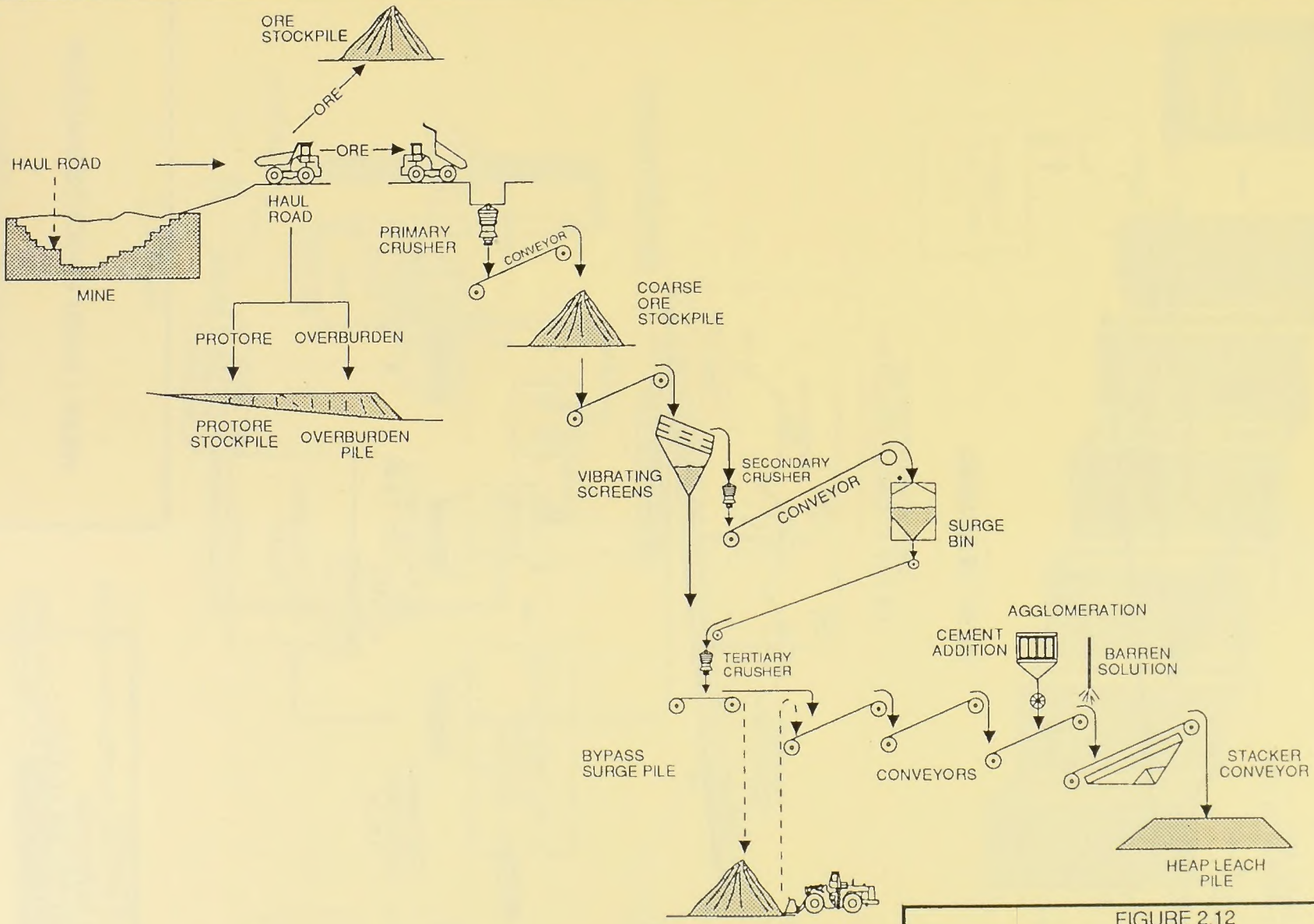
2. A detailed description of the crushing and conveying circuit can be found in Section 3.2.4.2 of the Draft EIS/EIR.

2.5.2 HEAP LEACH SYSTEM

1. The primary elements of the heap leach system are the Heap Leach Pads, solution storage facilities, and piping systems to distribute and circulate the leaching solution. This system is illustrated in Figure 2.13 (Heap Leach Process Diagram). Facilities design, construction, and operation of the heap leach system are governed by State regulations administered by the RWQCB.

2.5.3 GOLD RECOVERY

1. The gold recovery plant will receive and process gold-laden solution from the pregnant solution tank. Gold will be extracted from solution by an adsorption process using activated carbon, as shown in Figure 2.14 (Generalized Gold Recovery Plant Process Diagram). The barren solution resulting from this process will be returned to the barren solution storage tank for reuse.



SOURCE: CASTLE MOUNTAIN DRAFT EIS/EIR

FIGURE 2.12

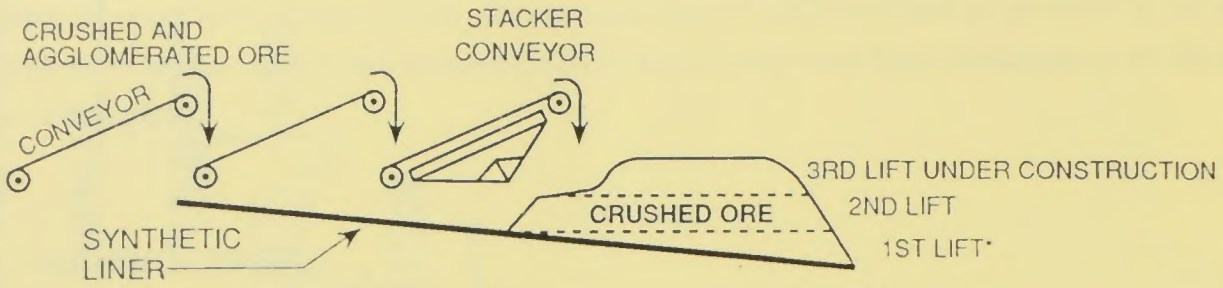
MINING AND CRUSHING OPERATIONS DIAGRAM

CASTLE MOUNTAIN PROJECT

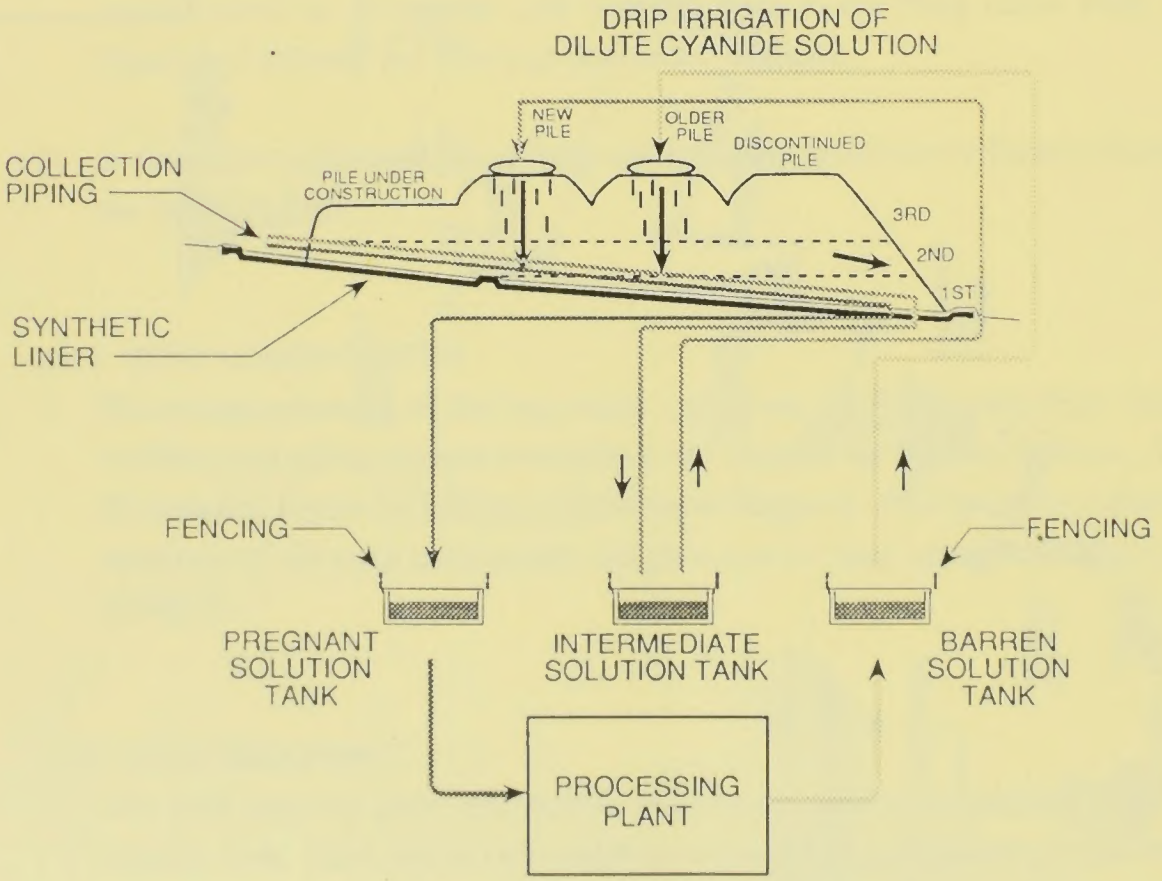
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HEAP LEACH PILE CONSTRUCTION



HEAP LEACHING



*NOTE

1. PILES MAY ALSO BE CONSTRUCTED WITH TRUCKS AND DOZERS.
2. HEAPS ARE CONSTRUCTED IN A SERIES OF LIFTS, EACH LIFT BEING APPROXIMATELY 15 TO 20 FEET IN HEIGHT.

SOURCE: CASTLE MOUNTAIN DRAFT EIS/EIR

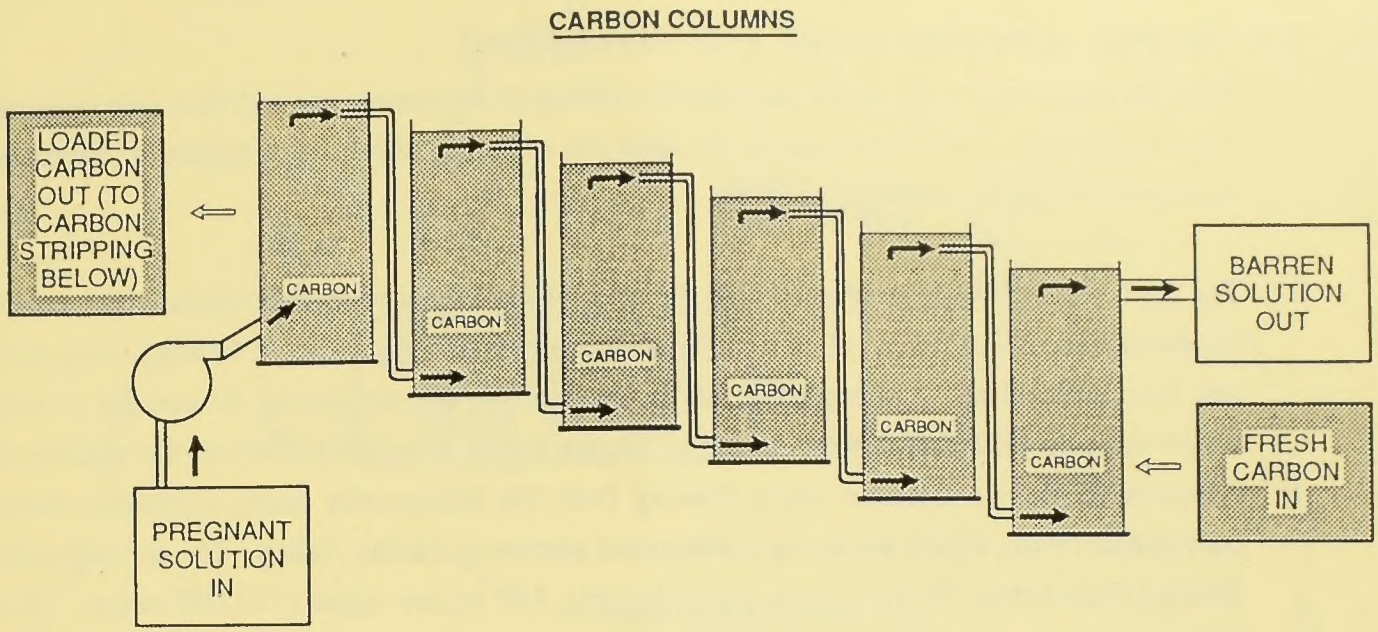
FIGURE 2.13

HEAP LEACH PROCESS DIAGRAM

CASTLE MOUNTAIN PROJECT

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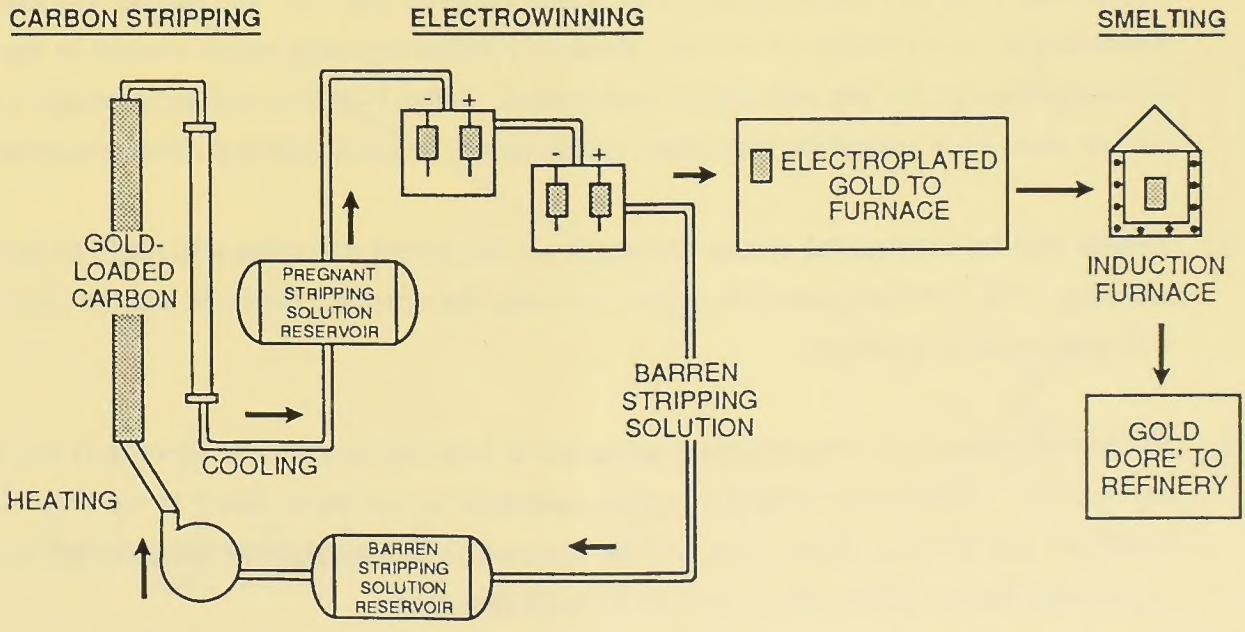


FIGURE 2.14

GENERALIZED GOLD RECOVERY PLANT PROCESS DIAGRAM

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

SOURCE: CASTLE MOUNTAIN DRAFT EIS/EIR

2.6 WATER IMPOUNDMENTS AND DIVERSIONS

1. With the exception of two areas, precipitation falling on the project site will flow into existing natural drainages. The exceptions are the open pits and areas which are underlain by the liners associated with heap leaching activities.

2. The open pits will be located at or near the crest of their respective watersheds which cover approximately 340 acres, as shown in Figure 2.15 (Watersheds Affected by the Lesley Ann and Oro Belle Pits). Although the pits will constitute approximately 40 percent of this watershed area (135 acres), water entering the pits would have little effect on the volume of downstream flows. Surface water flowing from the project site could ultimately reach Sacramento Wash, which drains the northeastern portion of Lanfair Valley. The drainage area feeding Sacramento Wash covers approximately 240 square miles (153,000 acres). The 340 acres of watershed that will be affected by the development of the open pits, and the 330 acres covered by the heap leach piles, each constitute only 0.2 percent of the Sacramento Wash watershed.

3. The main processing facilities are located on the alluvial fan portions of the project site. Facilities have been sited to conform to the topography, to minimize earthwork, and to avoid interfering with the major ephemeral water courses that cut across the alluvial fan. Accordingly, flows (which occur only during or following large storm events) in the main drainages through the site will remain undisturbed. Some V-ditches will be installed to divert surface sheet-flow around the immediate proximity of the leach pads and other structures.

4. Swales will be constructed across drainages on the access and mine site roads to facilitate crossing. The overland conveyor system between the crushing facilities and the leach pads will span existing drainages.

5. No impoundment structures will be constructed to intercept stormwater flowing in any of the dry washes. Stormwater falling on areas underlain by synthetic liners at the Heap Leach Facilities and Process Plant Area will be directed to the emergency solution storage and stormwater basins. These basins will be 20 to 25 feet deep.

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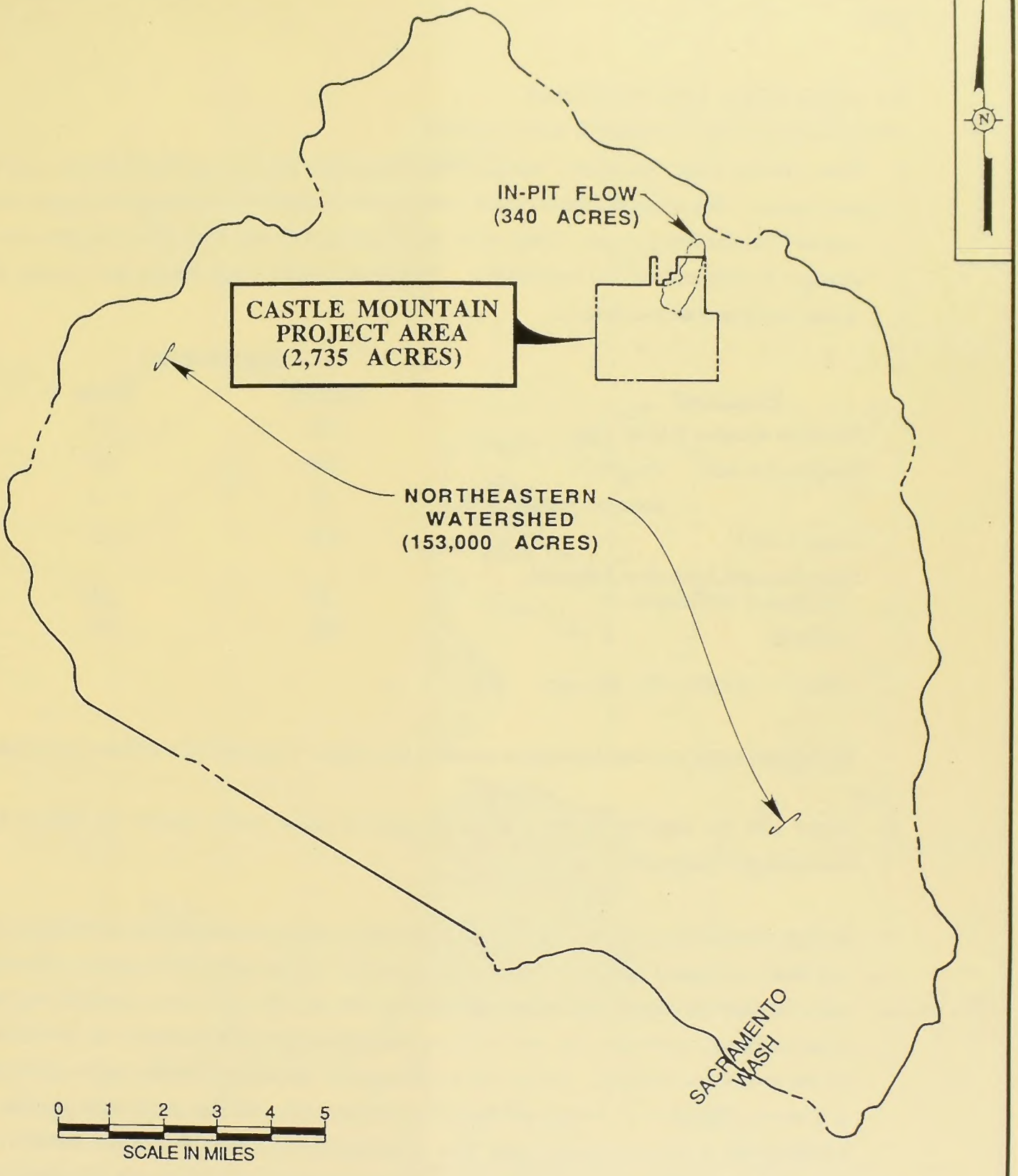


FIGURE 2.15

WATERSHEDS AFFECTED BY THE LESLEY ANN AND ORO BELLE PITS

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

SOURCE: FIGURE 3.6.1 BY VICEROY GOLD CORPORATION.

2.7 UTILITIES AND SUPPLIES

2.7.1 WATER REQUIREMENTS AND SUPPLY

1. Water for the Castle Mountain Project is needed primarily for the heap leach process and for dust control. On an annual basis, daily water usage is expected to average 450 gpm, for a total of 725 acre-feet per year. Daily water requirements will vary throughout the year, due to changes in temperature and evaporation. Anticipated water usage during the summer and winter seasons is shown below:

	Quantity (gpm)	
Water Use*	Summer	Winter
Moisture retained in heap piles	175	175
Evaporation loss: - Heap Piles	160	95
- Solution Storage Area	10	5
Dust Control	100	65
Miscellaneous, including domestic, equipment washdown, etc.	50	50
TOTALS	495	390

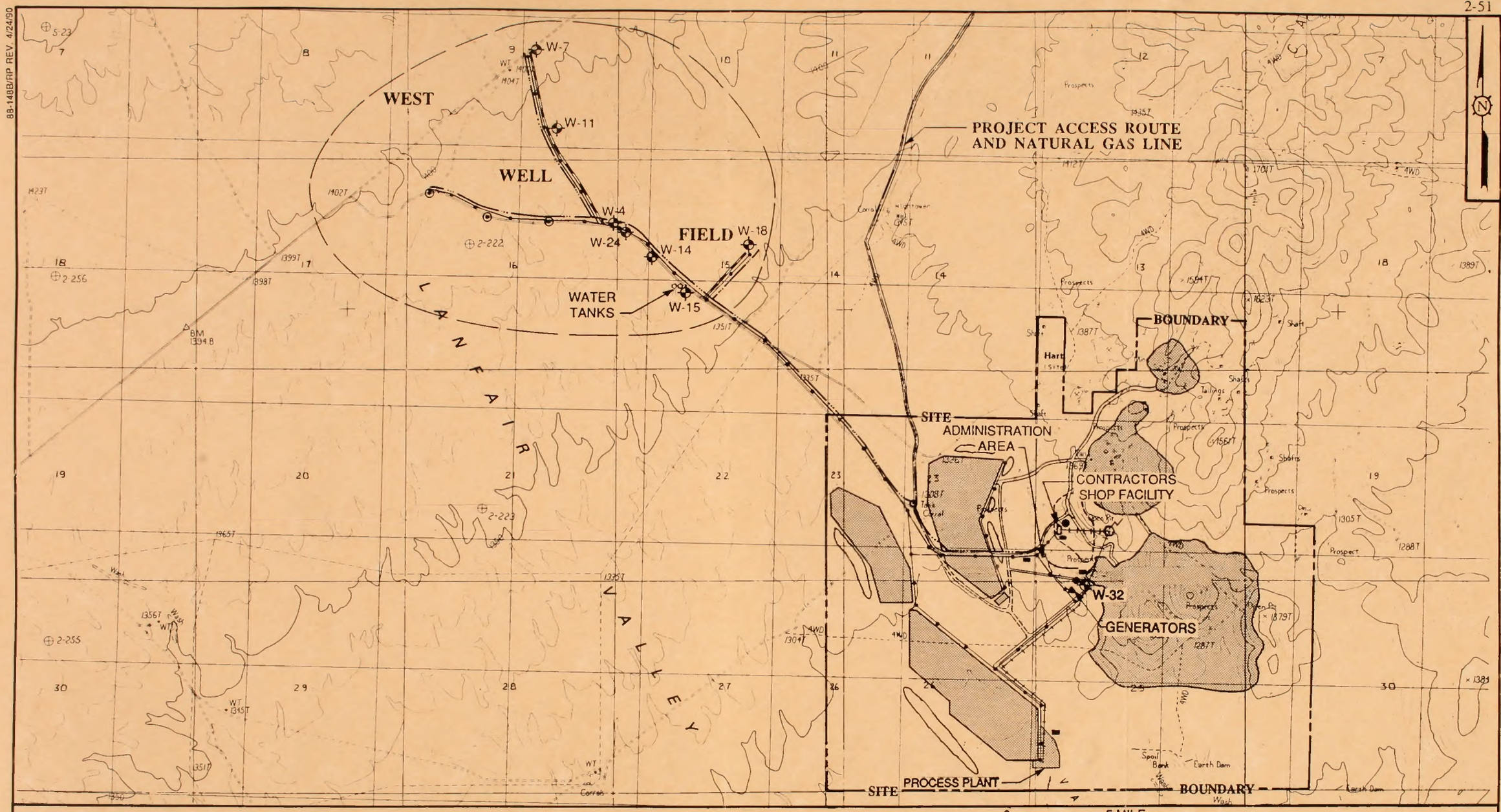
ANNUAL AVERAGE: 450 gpm

*Estimated water use based on actual consumption figures obtained from similar operations.

2. Water will be supplied from a series of ground water wells shown on Figure 2.16 (Preliminary Utilities Plan).

3. Surface disturbances at each well site will be limited to the area necessary to establish the well and house permanent facilities. Removal of vegetation will be limited to a 12-foot wide access road, the pipeline alignment, and an approximate 100- by 100-foot area to establish the well. After wells are completed, this area will be reclaimed to an approximate 25- by 25-foot area for the permanent facilities. Pumps will be powered by electricity from the onsite generators, as shown in Figure 2.16. Water will be delivered from each well site to the main pipeline via a buried pipe in the well service road. The main pipeline will be an 8-inch line buried in the shoulder of Hart Mine Road extending from the West Well Field to the site. Water will be stored adjacent to Well W-15 in a 100,000-gallon tank and a 40,000-gallon tank, located approximately as shown in Figure 2.16.

88-148B/RP REV. 4/24/90



WATER
- MAIN WATERLINE (8")
- EXISTING WELLS
- PROPOSED WELLS
- WATER TANKS
- SERVICE ROAD

POWER
- GENERATOR LOCATION
- POWER LINES
- FUTURE NATURAL GAS LINE
- PROPANE AND DIESEL FUEL STORAGE TANKS

COMMUNICATIONS
- TELEPHONE LINES
- MICROWAVE DISH

WASTE
- LEACH FIELD

MAJOR FACILTIES LOCATION

FIGURE 2.16

PRELIMINARY UTILITIES PLAN

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

2.7.2 OTHER UTILITIES AND STRUCTURES

1. The reader is directed to Section 3.2.5 of the Draft EIS/EIR for information on the following topics.
   - Power requirements and supply
   - Communications
   - Structures, equipment, and supplies

2. Locations of the power generating plant and communication facilities are shown in Figure 2.16.

3. In the later stages of project operation, the propane-fired generator units may be converted to burn natural gas for power generation. Natural gas would be provided by constructing a 4-inch diameter natural gas distribution line from the vicinity of Searchlight, Nevada to the project site. The pipeline would be buried within the alignment of the Project Access Route, to limit additional surface disturbance.

4. Ancillary structures, which include a laboratory and change room/office buildings, will be constructed near the gold recovery plant. An administration building will be located west of the Mining Contractor's Shop. These buildings will be furnished with water, electricity, heat, and sewerage to conform to requirements of the County Building and Safety Department and Department of Environmental Health Services (DEHS). A parking lot will be located adjacent to these buildings for use by employee van pool vehicles, company vehicles, and visitors. Provisions will be made for access and parking for handicapped persons.

5. The Mining Contractor's Shop facility will be located within the contractor's area south of the South Clay Pit Reclamation Area. This shop will be used for vehicle maintenance, with office space for administration and warehousing space for equipment parts. A truck ready line and other vehicle parking will be located nearby.

6. A general purpose maintenance shop will be located near the power plant and crushing facilities. This shop will be utilized for maintenance (including warehousing of spare parts) of power plant and crushing equipment.

2.7.3 SUPPLIES

1. Activities at the Castle Mountain Project will include the handling of chemicals, storage of hazardous chemicals, explosives, and the treatment and disposal of wastes. Potential contaminants that will be present at the project include both hazardous and non-hazardous materials.

2. Fuels and oils will be stored onsite. Tanks for these fuels and oils will be installed on prepared foundations enclosed with berms adequate to contain the contents of the tanks in the event of a leak or rupture, as determined by the DEHS. Storage facilities for reagents such as sodium or calcium cyanide and hydrochloric acid will also include secondary containment for spills.

3. Explosives and other blasting agents will be stored in facilities constructed and maintained in accordance with Federal and local permit requirements.

4. Chemical reagents will be brought to the site by various suppliers. In general, major chemical reagents will be handled and stored as described in Section 3.2.5.4 of the Draft EIS/EIR.

2.7.4 WASTE CONTAINMENT, TREATMENT, AND DISPOSAL

1. The project will generate solid and liquid wastes from construction, operation of equipment, and gold processing facilities. Wastes will be stored, recycled, or disposed of in accordance with rules and regulations set forth by the DEHS and in a manner acceptable to the BLM. The following are examples of anticipated wastes:

Waste Type	Waste Generated	Disposal Procedure
Domestic Waste	Paper	Recycle or remove to Class III landfill
	Plastic	Remove to Class III landfill
	Foods/Garbage	Remove to Class III landfill
	Glass	Remove to Class III landfill
Industrial Waste (non-hazardous)	Tires	Returned to supplier
	Metal	Recycle or remove to Class III landfill
	Wood	Recycle or remove to Class III landfill
Industrial Waste (hazardous)	Vehicle oil	Recycled or removed to appropriate hazardous waste landfill or treatment facility
	Solvents	
	Reagent/containers	

2. Wastes considered hazardous will primarily be liquids, such as waste oils and fuels from vehicles, solvents, and processing chemicals, and their containers and small volumes of reagents used in laboratory testing. Used oils and other waste hydrocarbon products will be stored in tanks located in a containment area. Solvents and chemicals will be recycled or packaged and disposed offsite by a licensed waste disposal contractor who will haul these items to an approved recycler or disposal site. When possible, processing chemicals and laboratory reagents will be neutralized onsite and incorporated into the barren solution system. Chemical containers will be rinsed and either returned to the supplier for reuse or sent to an approved disposal site.

3. Haulage of hazardous wastes will be by licensed carriers only. Reputable organizations capable of performing this function have been contacted. Following haulage, the hazardous wastes will be incinerated, treated, recycled, or placed in an approved hazardous waste landfill. Final disposition of the project's hazardous wastes will depend on the type of waste, and be in accordance with the rules and regulations for waste disposal set forth by the DEHS.

4. Where feasible, non-hazardous project wastes will be recycled, including items which are used in larger quantities, such as metal. Used tires will be sent back to the suppliers. Recyclers will leave empty containers at the site, pick them up when full, and recycle the products. To ensure that all recyclable products are deposited in the correct location, a written policy will be established dictating disposal locations for the various waste types.

5. Non-hazardous wastes to be placed in a Class III landfill will be temporarily stored onsite in refuse bins. These non-hazardous wastes will be transported to the Class III landfill in Barstow, California operated by the County. Haulage to the landfill will be in approved waste containers.

6. At some point during the project life, Viceroy may submit an application to the DEHS for a permit to dispose of certain non-hazardous wastes within an onsite overburden pile.

7. Domestic waste water from the Processing Area, Crusher Shop Area, and Administration Area will be disposed in septic tanks and leach fields adjacent to each of these areas, as shown on Figure 2.16. These disposal facilities will be designed and constructed according to requirements of the DEHS. Current estimates are that total waste water flows for the three

leach fields will be about 1,500 gallons per day, or 1.7 acre feet per year. Portable toilets will be used in areas not served by the main sanitary facilities, such as the mine pit. Maintenance of portable toilet facilities will be contracted to a licensed septic pumper.

8. The gold ore processing and extraction circuit will operate as a closed system. Rain which falls on the pads will enter the process circuit or evaporate. The heap leach solution storage system will be sized to RWQCB specifications to accommodate precipitation run-off.

9. Spent analytical reagents discharged from the assay laboratory area will be neutralized in the chemical neutralization sump of the processing plant, then transferred to the barren solution tank. Solutions containing cyanide chemicals discharged from the assay lab, will report to the process area sump, which in turn goes to the barren solution tank.

10. Geochemical testing has been completed on representative samples of overburden, protore, and ore to determine their acid generation potential and likelihood for solubilization of various metals (see Section 2.4.4). Based on results from this testing, percolation of water through materials removed from the pit will not adversely alter ground or surface water quality.

CHAPTER 3.0
RECLAMATION ASSURANCE

3.0 RECLAMATION ASSURANCE

3.1 INTRODUCTION

1. BLM requires bonding for cyanide heap leach operations on public lands in California. The County and RWQCB also have the authority to require bonding, to ensure that reclamation activities required as conditions of permit approval can be completed at no public expense in the event the sponsor abandons a project prior to completing required activities. Bonds to be posted by Viceroy for the Castle Mountain Project will guarantee completion of project reclamation to the satisfaction of the BLM, County, and RWQCB.

2. The RWQCB has the authority to issue waste discharge permits. As such, the RWQCB regulates certain facets of the project, including operating and decommissioning activities involving:
   - Heap leach pads and solution storage facilities.
   - Process area.
   - Overburden rock disposal area.

3. The documents submitted to the RWQCB in support of the waste discharge permit application include a detailed engineering report entitled *Castle Mountain Project, Heap Leach Facilities Design, Report No. 11505,* dated March, 1990. The report was prepared by Steffen Robertson and Kirsten, consulting geotechnical engineers. The report includes a Closure and Post-Closure Plan (Closure Plan), as required by state law. The Closure Plan is included in this document as Appendix D, Closure and Post-Closure Plan.

4. The Closure Plan describes the activities that will be undertaken to ensure the project is operated and decommissioned in a manner that conforms with the RWQCB's requirements. It also provides information regarding the bond to be held by the RWQCB, to ensure that financial resources will be available, if necessary, for decommissioning those portions of the project that are subject to RWQCB jurisdiction.

5. Overlap exists between the goals and intent of the Reclamation Plan and Closure Plan. Reclamation and closure plans have certain common objectives, such as ensuring that materials placed in piles will be stable and not present a hazard or nuisance to public safety and the environment, and that toxic chemicals are properly disposed. The particular focus of the Closure Plan is on the physical stability of earthen structures made up of overburden material or spent heap leach material, and maintenance of water quality both during operation

and after closure. The Closure Plan addresses the implementation of measures to protect water quality, such as detoxification of process chemicals and land contouring to avoid soil erosion and sedimentation.

6. The BLM and County, while concerned with such issues, are also charged under FLPMA and SMARA, respectively, with ensuring that other resource values, such as visual aesthetics, revegetation, wildlife, recreation, and activities important to the maintenance of a diverse local economy, are also addressed in reclamation plans.

7. Mining is a dynamic process that must be responsive to changes in economic factors, geotechnical conditions, as well as the results of exploration and definition drilling for ore reserves. As with most major projects, changes will occur throughout the construction and operational phases of this project. Viceroy and the appropriate regulatory agencies will review the plan prior to the start of each stage. Any changes can then be incorporated into an amended plan.

3.2 BOND REQUIREMENTS

1. Pursuant to an agreement between the BLM and County, they will jointly hold a single bond (the BLM/County Bond) for the reclamation of the Castle Mountain Project. BLM requires a bond from mining operations that employ cyanide leaching. The County's policy is to require bonding to the full extent of the estimated costs to complete the reclamation program. Accordingly, for the project, the County's requirements for bonding will be larger than BLM's.

2. The BLM/County Bond will be completely independent of the RWQCB waste discharge permit bond. Reclamation bond amounts will be assessed prior to the start of each stage. The amount of the bond will be based on the acreage to be disturbed at the end of each stage, multiplied by the appropriate cost factor, assuming the reclamation program was to be completed at the end of that stage. Unit and lump sum cost factors are discussed in Section 3.2. These factors will be reviewed with BLM and County officials prior to the start of each stage, so that up-to-date information will be reflected in the cost factors and in the bond amount.

3. To aid in the determination of bonding requirements, costs were developed for the locations corresponding to those described in Chapters 1.0 and 2.0. These locations are:
   - Lesley Ann Pit (and Oro Belle Pit in later years)
   - South Clay Pit Reclamation Area
   - South Overburden Pile
   - Ore and Low Grade Piles
   - Crushing Plant Area
   - Solution Storage Area
   - Process Plant Area
   - Heap Leach Pad Area
   - Roads (including Overland Conveyor)
   - General Project Site

4. A detailed list of reclamation costs to cover surface disturbances arising from activities undertaken during Stage 1 is given in Table 3.1 (Reclamation Costs, Stage 1). These calculations are based on the current operational plan for Stage 1, as described in Chapters 1.0 and 2.0.

5. Table 3.1 also shows the amounts to be posted with the RWQCB for the waste discharge permit bond (initial total $398,898). This amount was computed in response to instructions from the RWQCB that closure costs for activities that are bonded by the RWQCB be calculated at two year increments. Bonding amounts for the waste discharge permit will be reviewed with the RWQCB at two year intervals throughout the project's life. The closure bond amount will provide the RWQCB with sufficient funds to pay for those closure activities over which it has jurisdiction, in the event the Castle Mountain Project must be closed under worst case conditions.

6. There will be no duplicative coverage between the RWQCB bond, the BLM/County Bond, and any other bonds required for the Castle Mountain Project by any other governmental agency. Thus, activities covered by the RWQCB bond such as grading, foundation demolition, solution detoxification, pond liner burial, sludge handling, etc., will not be replicated in the BLM/County Bond. The procedures covered by the RWQCB bond amounts are recognized as adequate and controlling as to those reclamation requirements and are incorporated in this plan by reference. The RWQCB's purpose is to leave the area in a condition that avoids impacts to water quality. Therefore, the RWQCB bond goals are more limited than the BLM or County's total reclamation perspective that includes application of growth media and revegetation.

TABLE 3.1

RECLAMATION COSTS - STAGE 1

LOCATION	OPERATION	UNIT COST ($)	QUANTITY	BLM/COUNTY BOND		RWQCB* BOND AMOUNT
				GROUND PREP. COSTS	REVEGETATION COSTS(13)	
Lesley Ann Pit (1)	Rock staining	0.35	280,000 square feet	98,000		
South Clay Pit Reclamation Area (2)	Grade top surface*		Lump sum			2,400
	Growth media placement	1.05	63,500 LCY	67,000		
	Recontour crests	1.50	1,800 lineal feet	3,000		
	Revegetate	1,500.00	16 acres		24,000	
South Overburden Pile (3)	Grade top surface*		Lump sum			8,000
	Growth media placement	1.05	61,300 LCY	64,000		
	Recontour crests	1.50	4,800 lineal feet	7,000		
	Revegetate	1,500.00	41 acres		61,500	
Ore & Low Grade Piles (4)	Grade top surface*					**
	Recontour crests	1.50	5,300 lineal feet	8,000		
	Revegetate	1,500.00	18 acres		27,000	
Crushing Plant Area (5)	Foundation demolition, burial, & surface preparation*		Lump sum			97,500
	Growth media placement	1.05	10,800 LCY	11,000		1,000
	Revegetate	1,500.00	10 acres		15,000	
Solution Storage Area (6)	Solution detoxification		Lump sum			100,000
	Bury pond liners		Lump sum			98,100
	Sludge handling & disposal		Lump sum			9,178
	Growth media placement	1.05	12,100 LCY	13,000		
	Revegetate	1,500.00	5 acres		7,500	
Process Plant Area (7)	Foundation demolition, burial, & surface preparation*		Lump sum			33,750
	Growth media placement	1.05	12,100 LCY	13,000		500
	Revegetate	1,500.00	5 acres		7,500	
Heap Leach Pad Area (8)	Heap rinse/detox/raw water makeup*		Lump sum			29,370
	Grade (burying liners, etc.)*		Lump sum			17,400
	Growth media placement	1.05	50,800 LCY	53,000		
	Revegetate	1,500.00	21 acres		31,500	
Onsite Roads (including Overland Conveyor) (9)	Surface preparation*	100.00	17 acres			1,700
	Revegetate	1,500.00	17 acres		25,500	
Project Access Road (10)	Surface preparation	100.00	18 acres	2,000		
	Revegetate	1,500.00	18 acres		27,000	
County Road A68p (11)	Surface preparation	100.00	12 acres	1,000		
	Revegetate	1,500.00	12 acres		18,000	
General Project Site (12)	Fence around Lesley Ann Pit	1.75	6,600 lineal feet	12,000		
	Revegetate Soil Storage Areas	1,500.00	15 acres	22,500		
				374,500	244,500	398,898
			BLM/COUNTY BOND TOTAL		619,000	

88-148B (8/21/90)

TABLE 3.1

RECLAMATION COSTS - STAGE 1
(Continued)

NOTES: BCY = Bank Cubic Yards
LCY = Loose Cubic Yards

* = Closure costs covered by RWQCB bonding.
** = Costs covered in grade top surface costs for the South Overburden Pile.

(1) Rock staining is estimated in square feet of pit wall.

(2) The costs to finalize grading on the top surface are covered under the RWQCB closure bond. Recontouring the crest consists of pushing safety berm material over the crest and cutting the crest down three feet. This will result in a rounded appearance rather than a sharp linear physiographic feature. It is estimated that it will require a D9N track dozer one hour to do 100 lineal feet of crest. Growth media placement is assumed to cost $0.70 per ton of material placed. Growth media salvaged from the Lesley Ann Pit area and stockpiled is assumed to be placed on the South Clay Pit Reclamation Area. Revegetation costs are based on parameters described in Note 13.

(3) Growth media stockpiled from the area to be occupied by the South Overburden Pile would be stockpiled, and subsequently placed on the South Overburden Pile.

(4) Unit costs to recontour crests is as discussed in Note 2. Revegetation costs are based on parameters described in Note 13.

(5) Costs for foundation demolition and burial along with associated surface preparation costs are covered under the RWQCB closure bond. Growth media removed from this area would be placed back on the Crushing Plant Area. Revegetation costs are based on parameters described in Note 13.

(6) Costs to neutralize and evaporate ponds along with burying pond liners are covered under the RWQCB closure bond. Growth medial removed from this area would be placed back on the Solution Storage Area. Revegetation costs are based on parameters described in Note 13.

(7) Costs for foundation demolition and burial along with associated surface preparation costs are covered under the RWQCB closure bond. Growth media removed from this area would be placed back on the Solution Storage Area. Revegetation costs are based on parameters described in Note 13.

(8) Costs for detoxifying heap piles and grading (including liner burial) are covered under the RWQCB closure bond. Growth medial removed from this area would be placed back on the Solution Storage Area. Revegetation cost are based on parameters described in Note 13.

(9) Costs for surface preparation of onsite roads are covered under the RWQCB closure bond. Revegetation costs are based on parameters described in Note 13.

(10) Unit costs for surface preparation are based on $100 per acre for ripping and scarifying, similar to costs for these activities in the RWQCB bond. Revegetation costs are based on parameters described in Note 13.

(11) Costs are based on reclaiming two-thirds of the width of a 15 foot wide road, 9.5 miles long, leaving an undisturbed portion for an equestrian trail. Unit costs for ripping, scarifying and revegetation are as described in Note 10.

(12) Removal of three strand barbed wire fence is estimated from the book entitled Means Site Work Cost Data, 1989 (page 18). Fencing will be completed during Stage 1. Fencing costs are assumed to be $1.75 per lineal foot.

(13) The unit costs for revegetation are based on an allowance of $1,500 per acre for semi-arid land revegetation. This allowance was derived from information on the cost for seeds, placing seed in the ground, and transplantation of Joshua trees and cacti. This allowance was based on the following information (Newton, 1990):

- Costs for native plant seed of the species specified in Table 1.2 will range from $360/acre, if all seed is obtained from commercial stocks, to $765/acre, if some amount of custom collecting is necessary. These figures are based on information supplied in June 1990, by seed companies familiar with species common to the Mojave Desert, S&S Seeds in Santa Barbara, California, and wild seed in Tempe, Arizona.
- The method for placing the seed into the ground could vary from drill seeding ($100 - $300/acre), imprinting and seeding ($200 - $600/acre), hydroseeding/hydromulching ($1,000 - $2,500/acre), broadcast seeding by hand or by blower ($150 - $500/acre). These figures are based on available literature and information supplied in June 1990, by Suma Pacific, Grants Pass, Oregon.
- The plan proposes to transplant Joshua trees and cacti. Cost for transplanting Joshua trees range from $250 - $500 each. Costs for transplanting cacti are estimated at $25 - $100 each. These figures are based on information supplied between April and June 1990, by Joshua Tree National Monument; Smith and Reynolds, Corona, California; and Price's Nursery, Cathedral City, California.
- Costs that may be associated with this project, that vary widely, and that are not included in the $1,500/acre estimate, include fertilizer, fencing, irrigation, weed eradication, monitoring and maintenance. Some type of protection for plants placed out as cuttings, seedlings, transplants, etc., may be necessary. The cost of materials for plant protection varies greatly depending on the use of large-scale fencing versus individual plastic or metal netting cages. Irrigation systems are quite costly and vary based on factors such as quality of available water, frequency and duration of operation, type of system (overhead, drip, etc.), operation of system (manual versus computer controlled), overlap of raincircles, etc. Weed eradication, monitoring and maintenance vary based on project goals, sampling and reporting protocols, protection from disturbance, etc.

7. The BLM/County Bond will be in the form of a surety bond, a letter of credit, a sinking fund, or a savings account and will be administered by the County for the benefit of both agencies. Interest on interest-bearing financial instruments posted as security shall be credited to Viceroy.

8. The BLM/County Bond will integrate the $160,000 cash bond posted by Viceroy with the BLM for reclamation of roads and drill pads related to exploration activities. Most of those roads and pads fall within the project's proposed pit areas or other areas to be disturbed as the project proceeds. Viceroy posted that bond on October 24, 1988.

3.3 BLM/COUNTY BOND AND ADJUSTMENTS

1. The BLM and County will both use the same bond instrument to avoid duplicative coverage and efforts. The BLM and County will also make joint decisions concerning the initial amount of the BLM/County Bond and the annual adjustments to the BLM/County Bond.

2. There are several concepts which will control the method in which the Bond will be increased for additional disturbances and decreased for accomplished reclamation. The following concepts are to be utilized in setting the initial amount of the BLM/County Bond, and subsequent adjustments to the BLM/County Bond.

3. Reclamation activities have been scheduled over the project's life, by stage. The precise number of stages may change over time as the project progresses. However, any such changes will be incorporated into the bond analysis made at regular meetings between the BLM, County, and Viceroy, as discussed below.

4. The initial amount of $619,000 to be posted under the BLM/County Bond covers reclamation costs, excluding the RWQCB amounts, for all Stage 1 activities (see Table 3.1).

5. The initial BLM/County Bond amount and later bond increases, will be set based on the acreage to be disturbed during the upcoming year multiplied by the appropriate cost factors contained in this document. This procedure will ensure that sufficient funds are available, so the project could be totally reclaimed at the end of each stage. Recalculating reclamation bonding costs at Year 0, 1, 3, 5, 7, 9, 11, 13, and 15, will assure a current and accurate estimate of reclamation costs.

6. The BLM/County Bond will be adjusted periodically as discussed above. The initial meeting will be held approximately one month prior to the date construction is completed on the Primary Crusher. It is presently anticipated that completion of the Primary Crusher (which event marks the end of Stage 1) will occur 7 to 8 months after the start of construction of the project. Subsequent meetings will be held on or about the first, third, fifth, etc., anniversary date of the initial meeting. Adjustments will include increases based on any additional disturbances that are to occur within the next year as well as decreases to account for the percentage of reclamation that has been completed over the past year. Thus, increases are prospectively based on future activities, while decreases are retrospectively based on accomplished reclamation. Activities which will occur during Stages 2 through 10, such as mining the Oro Belle Pit, grading and growth media placement, and revegetation activities will cause adjustments to the BLM/County Bond using the procedures set forth herein.

7. Adjustments to the BLM/County Bond, both increases and decreases, will be made based on: (1) the location where the disturbance will occur or the reclamation activity has occurred, and (2) the type of reclamation activity being conducted. The main factor will be the location of the activity (e.g., process plant, heap leach pad, etc., see Table 3.1) with bond increase/decrease site-specific for each location. That is, locations such as the South Clay Pit Reclamation Area and South Overburden Pile will have their respective bond amounts adjusted up or down in isolation from other locations. Then, within each specific location, additional disturbance, recontouring, growth media placement, surface preparation, foundation demolition, etc., will be considered separately from revegetation, for the reasons set forth in paragraphs 10 and 11 below. For example, the BLM/County Bond will be reduced as rock staining of the pit walls was completed, or growth media placement is accomplished for the Crushing Plant Area. The bond amount covering revegetation of the Crushing Plant Area will be retained pending revegetation of that location. Therefore, the BLM/County Bond increases and releases will be site-specific per location, and within each location there will also be separate ground preparation versus revegetation adjustments.

8. For administrative efficiency, the BLM/County Bond will not be increased or decreased if the annual total adjustment, including all locations and operations, does not exceed $10,000.

9. The revegetation portion of the BLM/County Bond, as set forth below in paragraphs 10 and 11, although representing a minority of the overall reclamation costs, will be the most lengthy component in the reclamation process. The following method will be used to determine when to release the revegetation portion of the BLM/County Bond:

   - Releasing the revegetation portion of the bond will be conditioned upon Viceroy achieving the measure of success set forth in Section 1.3.5, paragraph 1. Success will be defined as achieving the revegetation goals for plant density and diversity set forth in that paragraph. The procedures used to achieve the revegetation goals will be determined through the Revegetation Research Program described in Section 1.4.
   - Revegetation success will be measured after the growing season five years after an area is planted. If the revegetation evaluation indicates that the goals have been met, then Viceroy's revegetation responsibilities for that area will cease and the bond amount remaining to cover revegetation of that area will be released to Viceroy in its entirely.
   - If the revegetation evaluation indicates establishment of revegetation on an area is less than the goals, only a portion of the revegetation bond for that area will be returned to Viceroy, and no further revegetation efforts on that area will be required of Viceroy. The refund for that area will be in the same ratio that the actual percentage density and diversity achieved at the end of the fifth year bear to the goals specified in Section 1.3.5, paragraph 1.
   - The revegetation concept, as with all other reclamation procedures, will be site-specific. For example, if revegetation is successful in the South Clay Pit Reclamation Area and the South Overburden Pile, the bond amounts covering those areas will be released, although the portion of the Bond assigned to revegetation for the Crushing Plant Area will continue as set forth above, if revegetation was not initially successful in that area.

10. The bond release mechanism set forth in this section is based on the knowledge that grading, recontouring, growth media placement, structure demolition, etc., are relatively short-term requirements that can be completed within a few months once started; whereas revegetation is a longer-term process.

11. Grading, recontouring, growth media placement, etc., constitute the majority of the total reclamation costs both for this project and for mining projects generally (Kekerix and Kay, 1986). For example, for Stage 1 of this project, the cost of grading, recontouring, growth media placement, etc., constitutes 60 percent of the total Stage 1 BLM/County reclamation costs, whereas revegetation comprises only 40 percent of that amount. If the RWQCB bond amount of approximately $400,000 is included in this analysis, none of which includes revegetation, revegetation only constitutes 25 percent of the total reclamation costs set forth for

Stage 1 in Table 3.1. The ground-preparation reclamation activities are also the most capital intensive, therefore the majority of the BLM/County Bond will be released several years before revegetation portions of the BLM/County Bond are released.

12. The BLM and County will jointly monitor Viceroy's compliance with the requirements of this section. If any of the required reclamation activities are not completed, the BLM/County Bond will be used to complete any such activities.

CHAPTER 4.0
SUPPLEMENTAL INFORMATION

4.0 SUPPLEMENTAL INFORMATION

4.1 INTRODUCTION

1. This chapter is a summary of information based upon studies completed for the Castle Mountain Project Draft EIS/EIR and Supplement. If more detailed information concerning the environmental setting is desired, the reader is referred to those documents. Appendix E: List of Permits and Approvals is also provided as supplemental information.

2. The project is located in the Hart Mining District of San Bernardino County, about 100 miles east of Barstow, California, and about 70 miles south of Las Vegas, Nevada, as shown in Figure 4.1 (Regional Location Map). Hart is an area of historic gold and clay mining activity on the southwest flank of the Castle Mountains in Lanfair Valley, as shown in Figure 4.2 (Vicinity Map).

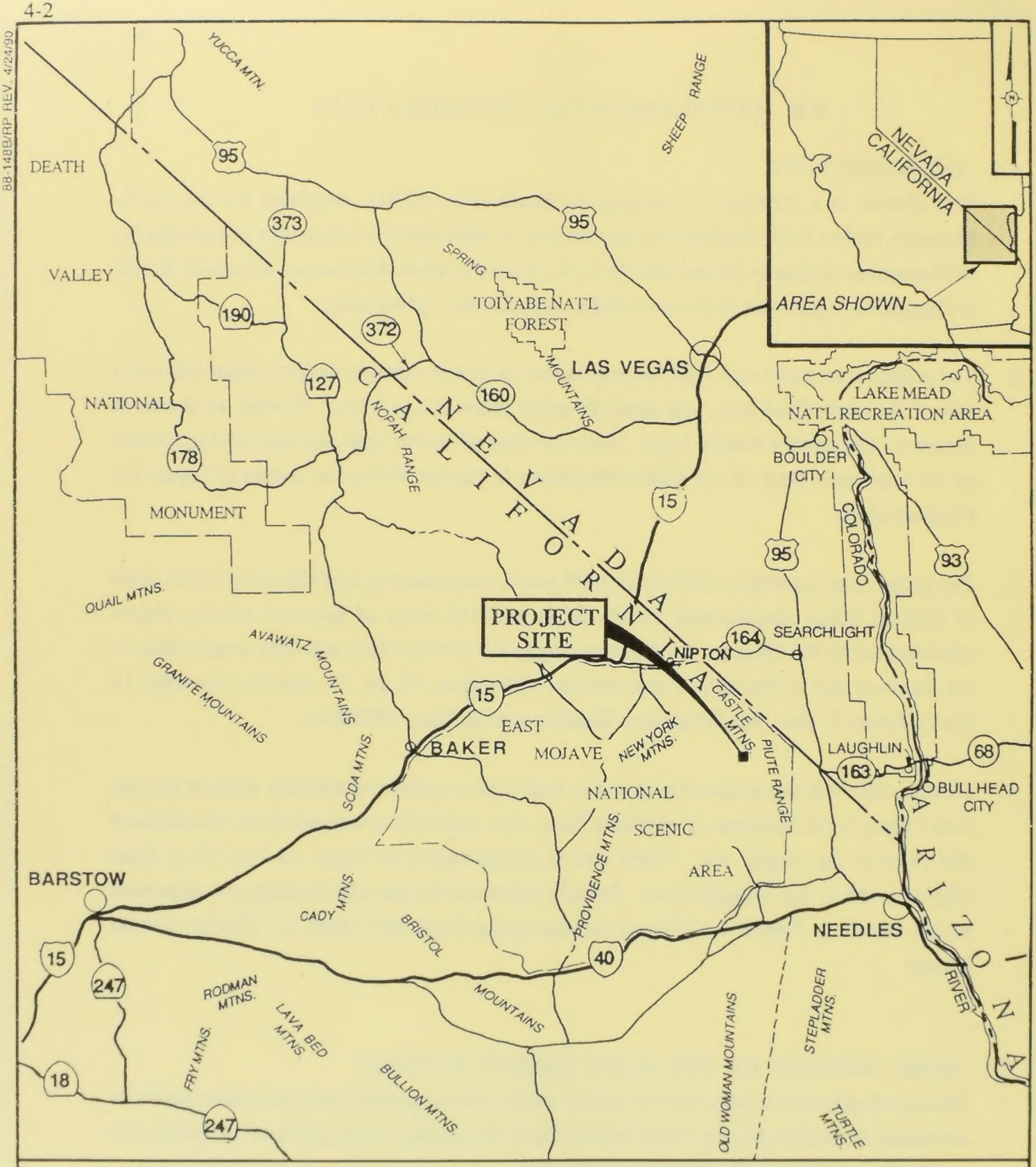
3. The project site is comprised of about 2,735 acres, encompassing approximately 2,620 acres of Federal lands administered by the BLM and 115 acres of patented mining claims administered by the County. As shown in Figure 4.3 (Project Site) activities would occur in the southern half of Section 13 and portions of Sections 23, 24, 25, and 26, Township 14 North, Range 17 East, San Bernardino Baseline and Meridian (SBB&M).

4. Existing access to the project site from the west (Los Angeles metropolitan area) or the east (Las Vegas) is via Interstate 15 to Nipton Road, then southerly to Ivanpah Road, to a series of dirt roads to the project site. There also is access from Las Vegas via U.S. 95 to State Highway 164 to the Ivanpah Road. Primary access to the site will be along the alignment access shown in Figure 4.4 (Project Access Route Map) and Table 4.1 (Project Access Route).

4.2 BRIEF HISTORY OF THE HART MINING DISTRICT

1. Mining has occurred at other sites in Lanfair Valley, but the greatest past and present activities are related to the Hart Mining District of the Castle Mountains, where gold and fine kaolin clay are found on and in the vicinity of the project site.

88-148B/RP REV. 4/24/90



0 15 30 MILES

SCALE

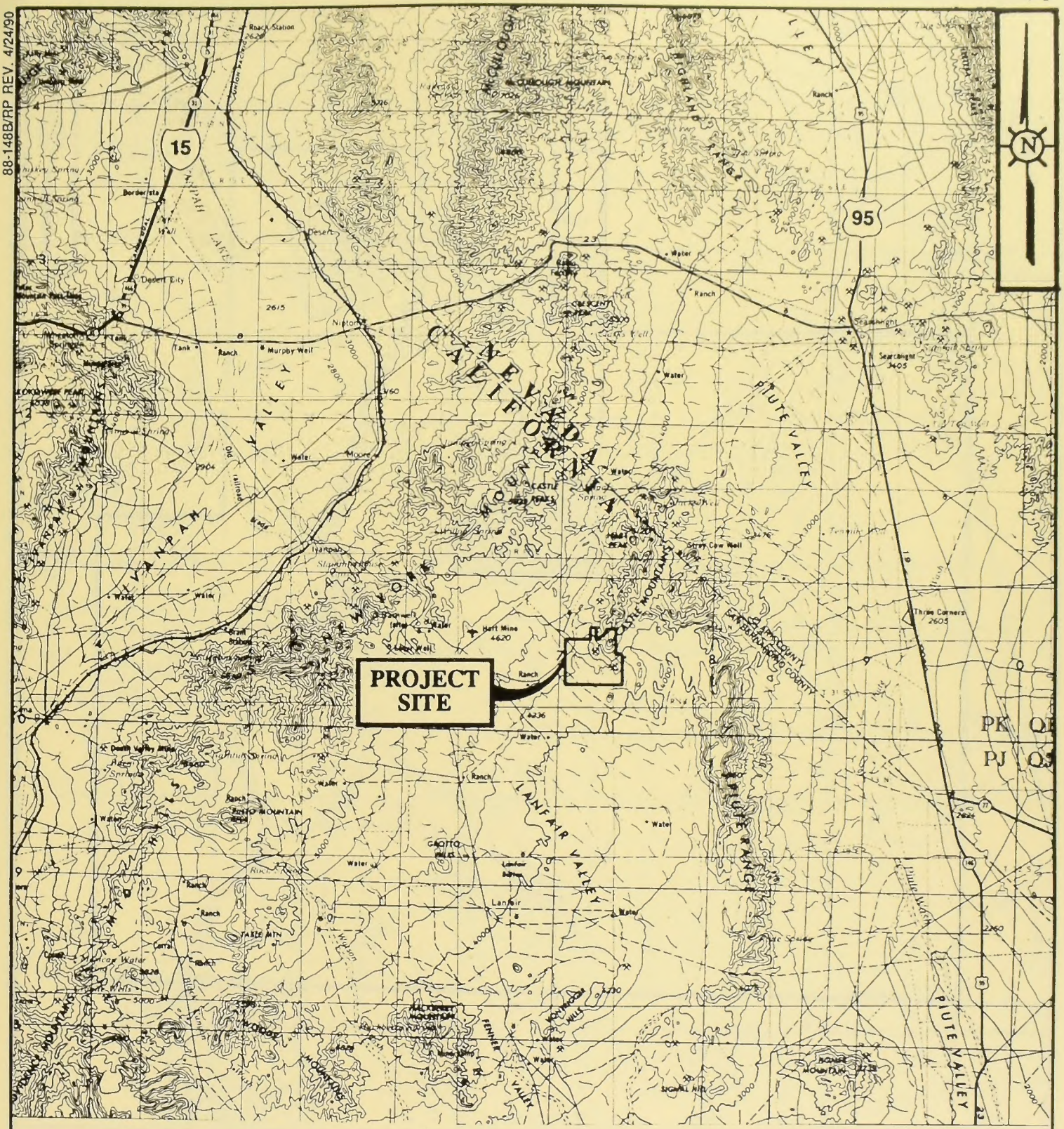
FIGURE 4.1

REGIONAL LOCATION MAP

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

88-148B/RP REV. 4/24/90



0 6 12 MILES

SCALE

FIGURE 4.2

VICINITY MAP

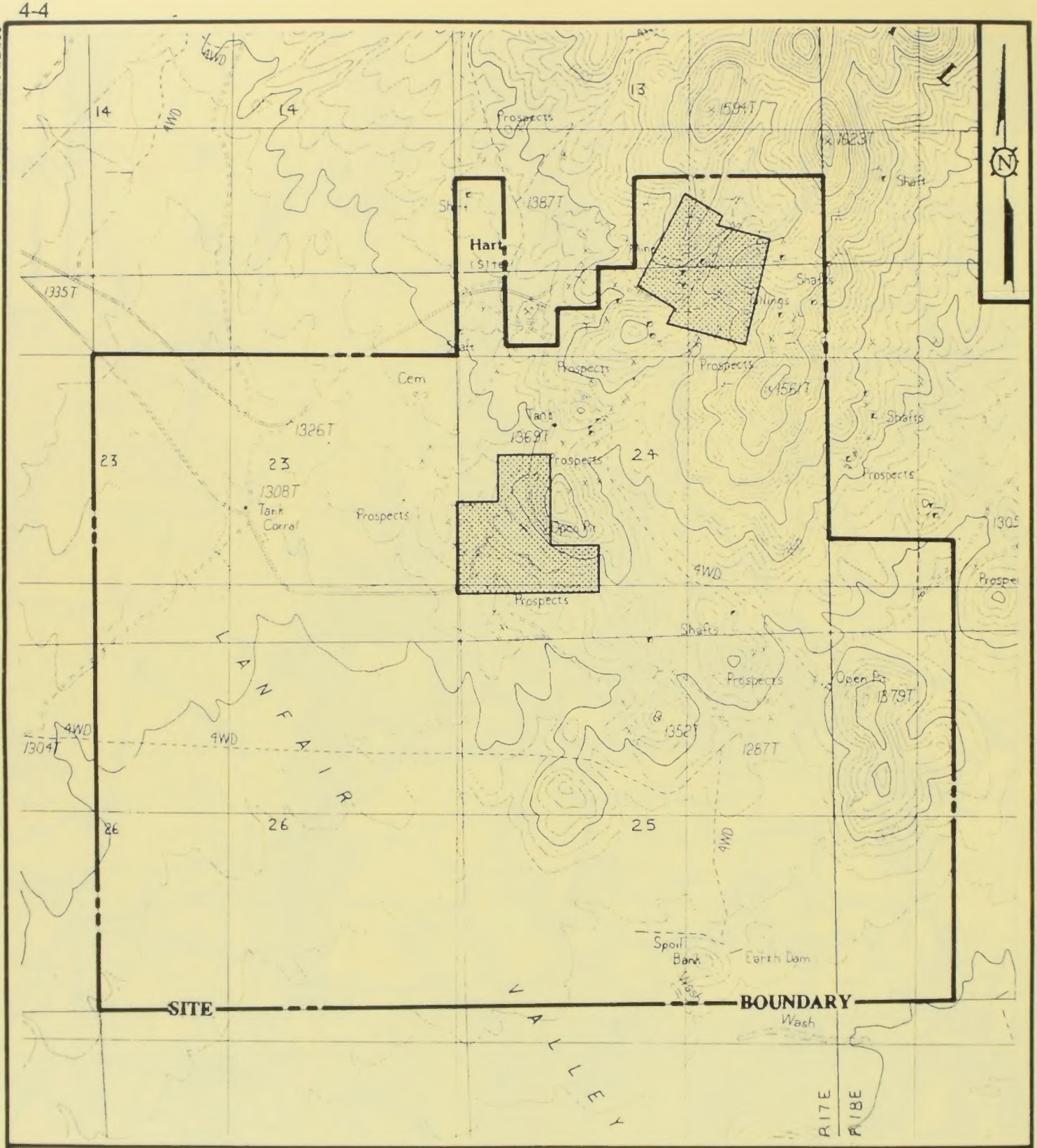
CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

CONTOUR INTERVAL: 50 METERS

REFERENCE: U.S.G.S. TOPOGRAPHIC V502 SERIES MAP - NI 11 - 3 BASE OF KINGMAN, ARIZONA-NEVADA-CALIFORNIA DATED 1954 AND REVISED 1969

88-148B/RP REV. 4/24/90



LEGEND

BLM - ADMINISTERED LAND (2,620 ACRES)

PATENTED LAND (115 ACRES)

0 .5 1 MILE

SCALE

LEGAL DESCRIPTION:

T. 14 N., R. 17E., SBB&M
SEC. 13: S 1/2 OF SE 1/4 AND W 1/2 OF SW 1/4 OF SW 1/4
SEC. 23: ALL, EXCEPT N 1/2 OF N 1/2
SEC. 24: ALL, EXCEPT E 1/2 OF NW 1/4 OF NW 1/4, AND NW 1/4 OF NE 1/4
SEC. 25: ALL; SEC. 26: ALL OF NW 1/4

T. 14 N., R. 18E., SBB&M
SEC. 19: SW 1/4 OF SW 1/4
SEC. 30: W 1/2 OF W 1/2

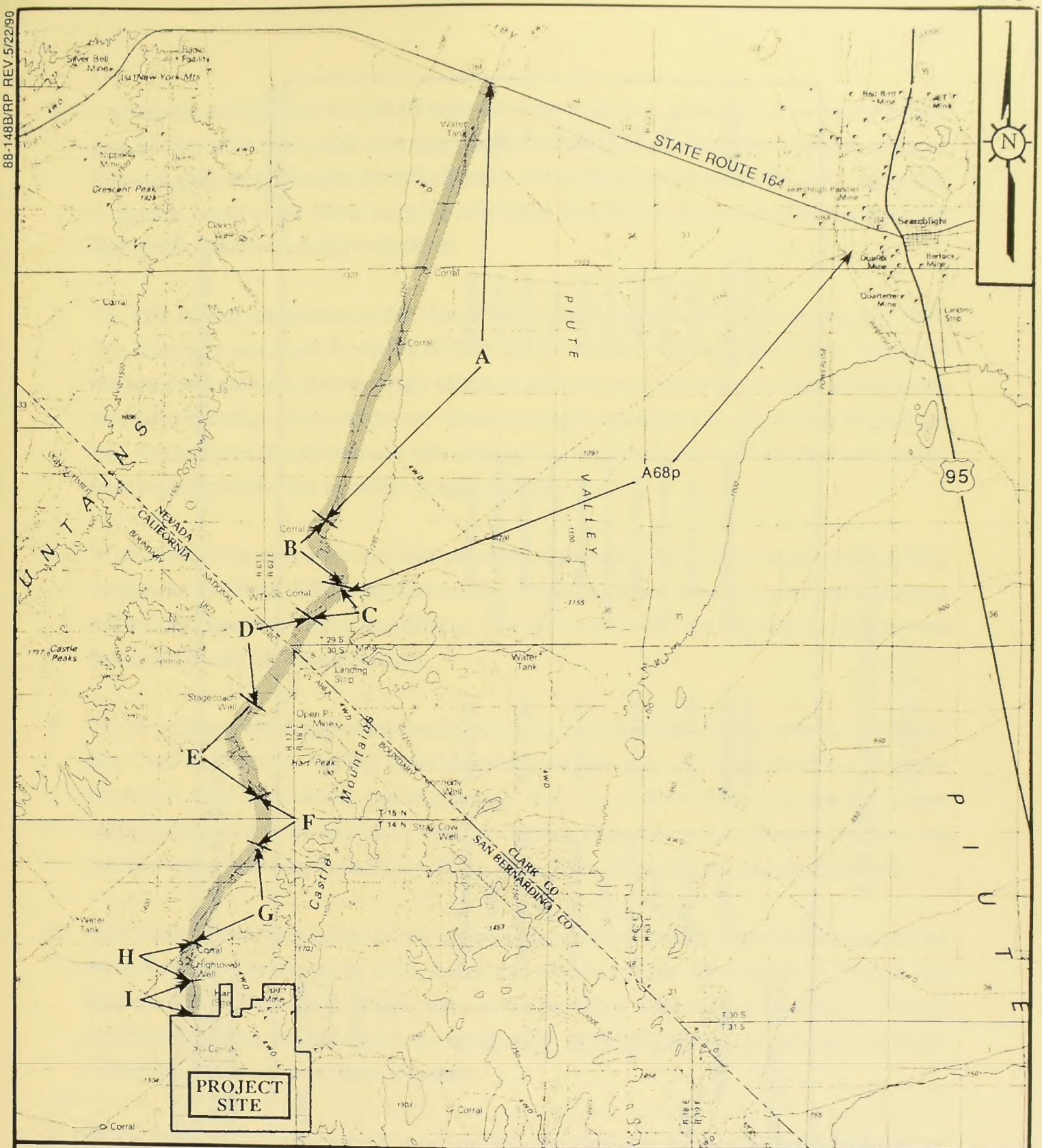
FIGURE 4.3

PROJECT SITE

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

88-148B/RP REV 5/22/90



ACCESS ROUTE

MILES		ACRES
14.1	WIDEN EXISTING ROAD	15.4
4.5	CONSTRUCT NEW ROAD	10.9

REFERENCE: 7.5 MINUTE U.S.G.S. TOPOGRAPHIC MAPS IVANPAH, CALIFORNIA-NEVADA; DAVIS DAM, ARIZONA-NEVADA; MESQUITE LAKE, CALIFORNIA-NEVADA; BOULDER CITY, ARIZONA-NEVADA-CALIFORNIA DATED: 1985, 1982, 1985, AND 1983 RESPECTIVELY

FIGURE 4.4

PROJECT ACCESS ROUTE MAP

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

TABLE 4.1
PROJECT ACCESS ROUTE

MITIGATED SEARCHLIGHT ACCESS ROUTE

Road Segment	Length (miles)	Status	Approximate Existing Width	Proposed Improvement[1]	Maintenance Responsibility[2]	Reclamation
A YKL Ranch Pipeline Road	7.7	Graded dirt	10 to 12 feet	Grade and widen	Applicant	No
B None	1.2	Vacant	--	New road construction	Applicant	Yes[3]
C Unnamed Trail	0.8	Unimproved trail	10 to 12 feet	Grade and widen	Applicant	Yes
D None	1.9	Vacant	--	New road construction	Applicant	Yes
E Unnamed Trail	1.8	Unimproved trail	10 to 12 feet	Grade and widen	Applicant	Yes
F None	0.9	Vacant	--	New road construction	Applicant	Yes
G Unnamed Trail	2.3	Unimproved trail	10 to 12 feet	Grade and widen	Applicant	Yes
H None	0.5	Vacant	--	New road construction	Applicant	Yes
I Unnamed Trail	1.5	Unimproved trail	10 to 12 feet	Grade and widen	Applicant	Yes

SUMMARY:

Access Route Length	18.6 miles
New Road Construction	4.5 miles
Improvements to Existing Road	14.1 miles

88-148B (7/26/90)

(1) Road widening would be limited to about 20 feet.
(2) Maintenance by Applicant includes signage, grading, graveling, and dust control.
(3) The YKL Ranch pipeline service road will not be reclaimed because it will continue to be used for access to grazing operations on northern pastures following completion of Castle Mountain Project.

2. Exploration activity over the last 80 years has been extensive, as evidenced by numerous test pits, dumps, shafts and other workings throughout the District. Available evidence suggests that total gold ore production from the District was probably less than 20,000 tons. According to reports, some of the direct shipping ore mined in the early days of the District was very high grade, relative to today's standards.

3. The first mining discoveries in the Hart Mining District were made on December 19, 1907. The discovery was made by James H. Hart and the brothers Bert and Clark Hitt. Typically the veins and stringers carrying high values of gold ore were very narrow, their widths being measured in inches. Most of the ore mined averaged around one to two ounces of gold per ton. It is reported that the ore was free-milling, i.e., it needed only to be crushed and washed with water to remove the worthless gangue material.

4. When word of the rich discovery was conveyed in January 1908, miners began arriving from throughout the West. Within the first week of Hart's existence, it had six tents and two stores opened by merchants from Searchlight. By February 1908, the population of Hart was between 400 and 700 (sources vary).

5. The three mines which appear repeatedly in mining news from the district were the Oro Belle, Big Chief and Jumbo. The Big Chief reportedly had the only mill in the district, a 20-stamp operation. The other mines had to transport their ore to Searchlight (the nearest custom milling facility) or to the smelter in Needles. Mining properties which appeared briefly in the records were: Florence, Twin Peaks, Flyer, Piute Belle, Todd Hunter, and the Zincaraffe.

6. Like many frontier mining camps, the town's fortunes faded quickly when the rich ore proved to be limited. The census in 1910, listed only 40 inhabitants. On January 5, 1911, a fire destroyed half of the town, though many of the buildings were already abandoned. For all practical purposes the fire ended the town's life. By 1919, when a government surveyor visited the site, it was completely deserted.

7. In the early 1920s development began on the clay alteration zones associated with the ore deposits. Since these zones ranged in width up to several hundred feet, they represented a large potential source of clays. Although most of the clays mined at Hart found their way into what is euphemistically called "sanitary ware", i.e., toilets and lavatories, they have more recently been used in the very popular Franciscan Ware.

8. In the 1930s large quantities of clay were mined and shipped from the Hart properties. The largest and certainly the most visible of the mines is the P.S. Hart. This quarry was opened on the southwest side of what is known as the Big Chief Hill. High on the north face of the P.S. Hart quarry wall, one of the old Big Chief tunnels can be seen. Everything south of where the quarry wall sliced through the tunnel is gone. The quarrying activities also obliterated the surface workings of the Big Chief Mine. Clay production was reported at 50,000 tons in 1953, and exceeded 200,000 tons in 1957.

9. Another clay deposit, known as the C-1 Clay Mine, encompasses the original townsite of Hart. The C-1 deposit is privately-held, owned by a conservation organization. Production is now limited to periodic shipments from a stockpile of clay on the quarry.

10. Efforts were made during World War I to reopen the old gold mines at Hart, but they were unsuccessful. The next period of activity occurred in 1932-1942, when the Big Chief Mine was operated as the Valley View. An old shaft was used and a cyanide mill was set up on the ridge between the Jumbo and Big Chief. Apparently the mine never reopened after the war, and the mill was dismantled and sold in 1951. All that remains of this operation are the concrete floors of the bunkhouse, assay office and the foundations of the cyanide mill. The tailings from the cyanide mill can be seen in the small wash adjacent to the mill site.

11. Sporadic exploration efforts in the Hart Mining District were conducted in the late 1960s, 1970s and again in the early 1980s in response to rising gold prices. In 1985, Viceroy acquired operating control of an exploration program on three patented lode mining claims and 21 unpatented lode mining claims. Since then, the balance of the lands included within the site boundary shown in Figure 4.3, have been acquired, either through negotiation with the owners of the possessory interest in the minerals, or by location of unpatented lode mining claims on open ground.

12. To date over 434,000 feet of drilling have been completed under previously approved Plans of Operation and over 3,000 feet of old underground workings have been reentered and sampled. The exploration program has delineated three ore deposits, two of which have had sufficient engineering performed to be able to estimate ore tonnage and overburden ratios. Ore reserves and potential resources that could be designated as ore grade material (subject to favorable economics) in the deposits proposed for mining at this time are approximately 30 million tons.

4.2.1 ONSITE MINING PHASES

1. The project site has seen at least five periods of mining activity, extending over a time span that could have begun some 10,000 years ago.

4.2.1.1 8000 B.C. - 1900 A.D.

1. The Cultural Resource Assessment (UCR, 1986) performed over the project area located five aboriginal quarry sites. The aboriginal peoples, who could have been in the area circa 8000 B.C., through time worked the quarry sites to recover chalcedony, jasper and silicified volcanic rocks. Typical of such quarry sites, only the rejects remain. No tools other than one basalt hammerstone were found. Cores and flakes in abundance were found at these sites. Although no absolute date can be assigned to these sites, they are of obvious antiquity and may have been used subsequently by the Indians of the area up until about 1900.

2. It is also probable that these people and the more recent Indians who inhabited the region obtained pigments from the vein outcrops that became mining sites in the twentieth century. Given the fact that the outcrops discovered in December 1907, contained considerable free-gold, larger pieces (nuggets) may have been collected by the Indians as novelties. There is no evidence that this occurred in the Hart Mining District.

4.2.1.2 1908-1911

1. The most intense mining occurred during the period 1908-1911, when the Hart Mining District was at its peak activity, as described earlier. The largest site of surface disturbance was at the Hart townsite which served the resident miners, but most mining activity took place in the underground mines of the district.

4.2.1.3 1930-1942

1. The third period of mining in the Hart Mining District began with renewed gold mining activity spurred on by the increase in the price of gold from $20 per ounce to $35 per ounce during the Roosevelt administration. The northern portion of the Big Chief, near the Jumbo, was the site of the Valley View Mine. War Production Board Order L-208 closed almost all gold mines in the country, including all mining activity in the Hart Mining District, shortly after the United States entered World War II.

4.2.1.4 1920-Present

1. Initial development of the clay mines of the district began about 1920. This activity overlapped the third and fifth periods, and was centered on the previously ignored alteration clays and kaolinite found there.

4.2.1.5 1985-2000

1. The fifth cycle of the Hart Mining District started in the early 1980s with the initiation of an exploration drilling program in which Viceroy participated. Viceroy assumed management of the program in 1985. The success of this exploration program has created the Castle Mountain Project. The presently delineated reserves and additional reserves that should arise from the ongoing exploration program will ensure a mining operation of at least 10 years duration at a mining rate of approximately three million tons of ore per year.

4.3 VISUAL RESOURCES

4.3.1 VISUAL MANAGEMENT

1. The BLM system of Visual Resource Management (VRM) is an analytical process used to identify and quantify scenic values and visual quality. Values are assigned to areas based on a class system ranging from Class I, areas of greatest sensitivity, to Class IV, areas of least sensitivity. The project site is within an area rated Class III. The objective of Class III is to partially retain the existing character of the landscape. Compared to Class I and Class II, Class III allows for a larger scale development or activity and one which would be an obvious and distinctively different feature from the existing landscape (BLM, 1988a).

2. The project is located in the EMNSA. Guidelines for management of this area have been defined in the EMNSA Plan (BLM, 1988a), which established the policy that discretionary actions should be designed to meet the VRM Class II standard. Non-discretionary actions (such as mining) are required to be designed to be as visually unobtrusive as "best practices" allow.

3. The policies of the County for visual resources as set out in the General Plan relate to designated scenic routes. The nearest County-designated scenic route is Interstate 15, from the Afton interchange to Baker. This route is about 50 miles west of Lanfair Valley; the project site cannot be seen from any portion of Interstate 15.

4.3.2 REGIONAL CHARACTERISTICS

1. As described in the EMNSA Plan, the visual attributes of the EMNSA do not reside in any particularly spectacular feature, but in the area's spectacular range of features (BLM, 1988a). This variety in the desert landscape encompasses mountains and valleys, with vegetation ranging from pinyon-juniper forests to Joshua tree woodland to creosote bush scrub and blackbush scrub. Because of the variable topography and generally sparse vegetation, long distance views are commonly available. These two elements, variety and the long-distance view, are the most significant characteristics of the East Mojave Desert's visual quality (BLM, 1988a).

2. Lanfair Valley exhibits characteristics common to the visual quality of the east Mojave region. The large, 340-square mile basin is enclosed by the Piute Range and the Hackberry, Woods, Table, New York, and Castle Mountains. The New York Mountains, which form the western boundary to the valley, are notable as one of the highest ranges in the East Mojave Desert, with elevations over 7,500 feet. The Castle Mountains form the northeastern limit of the valley, reaching a height of about 5,400 feet at Hart Peak.

3. Human modifications in Lanfair Valley include the abandoned Barnwell and Searchlight Railroad grade, improved and unimproved dirt roads, and features related to past and present cattle grazing, agriculture, and mining activities. Corrals, water tanks, and fencing are scattered throughout the valley in support of active grazing. Mining activities have occurred in the Castle Mountains, Vontrigger Hills, Signal Hill, and the New York Mountains.

4. The improvements for the Project Access Route will occur on relatively flat and gently sloping alluvial plains at the western margin of Piute Valley and between the Castle and New York Mountains. Creosote bush scrub vegetation on the floor of Piute Valley changes to a dense Joshua tree woodland at higher elevations near the northern Castle Mountains. Various unmaintained dirt roads lead to inactive and active mining claims in the area and to cattle ranching corrals and watering facilities. Portions of the former Barnwell and Searchlight Railroad grade are used as roads. Other portions, particularly where the grade was built in intermittent streambeds, have been washed away or otherwise abandoned for other preferred routes in the area.

4.3.3 PROJECT SITE CHARACTERISTICS

1. The project site includes ridges, canyons, and alluvial slopes, with elevations ranging from about 4,200 to 5,100 feet. Exposed soils and rock outcrops vary in color from reddish-brown to nearly white. Vegetation density is greatest in the Joshua tree woodland/creosote bush scrub on the valley floor, while vegetation cover is sparse over most of the mountain slopes.

2. Human modifications are primarily a result of past and present mining activities. Access roads lead to the location of the abandoned mining town of Hart, and to onsite clay quarries. Onsite roads lead to former mine workings or are related to exploratory drilling. The roads form distinct lines on the landscape, due to the lighter color of earth materials exposed below the surface. The clay quarries are the most intensive surface disturbing activities to date, both in size and in degree of color contrast. The most visually prominent clay pit (referred in this document as the South Clay Pit) is located on the west face of Big Chief Hill. Because the clay deposits are nearly white in color, they can be seen from locations more than 15 miles away in Lanfair Valley.

3. Views of the project site are confined to certain locations within Lanfair Valley. Views from the north and east are generally restricted by intervening topography, but distant views from the south, west, and northwest are available. Most public views are from Ivanpah Road, a rural, graded dirt road with low traffic volumes of 50 to 80 ADT (SBDOT, 1988), which enters the valley from the west. Other views by the general public can be obtained from local unimproved 4-wheel drive dirt roads which average fewer than 10 vehicles per day.

4. The project site is within viewing distance of two WSAs, as shown in Figure 1.1. WSA 266 encompasses the northern Castle Peaks area of the New York Mountains, northwest of the site. WSA 267 encompasses the Piute Range and eastern slopes of the Castle Mountains. The project site is not readily visible from this WSA, although distant views (more than four miles) are available from central portions of the Piute Range.

4.3.4 VISUAL DESCRIPTION OF THE AREA

1. From Lanfair Road, the existing clay quarries are visible as light-colored areas against the darker backdrop of the Castle Mountains. Numerous access roads leading to dozens of old mine workings and recent exploration sites are visible throughout the area, and most of the old

workings are either fenced or barricaded for safety. The present condition of the area, is largely the result of mining in an era when reclamation was *not* required, as shown in Figure 1.2.

2. Reclamation procedures to be used by Viceroy, including rock staining of upper mine pit walls, grading to reduce straight line geometrics, and revegetation, are intended to effectively mitigate the visual contrasts of the Castle Mountain Project. Reclamation efforts for the project will include previously mined areas, such as the South Clay Pit on Big Chief Hill. Reclamation of the clay pit will result in a major improvement when compared to the existing visual contrasts. Viceroy has recently acquired the North Clay Pit, so that it can be included in the overall reclamation program. Reclaiming these clay pits is expected to result in a more aesthetically pleasing view after the area has been reclaimed, as compared to current conditions.

4.3.4.1 Castle Mountain Project

1. The project will affect the visual character of the site by changing its nature from passive to active during the operational period, and by long-term changes to the site's topography, surface material and vegetation cover. The potential effects of activities on the visual environment are evaluated in the following paragraphs.

2. Portions of each of the major project components will generally be visible to public view from areas northwest, west, and south of the project site. The degree to which each component will be visible will be related to the ultimate project configuration and the specific location of the observer in relation to intervening vegetation and topography. The scale of the mine pits, overburden, and heap leach piles will greatly alter the visual environment when viewed from onsite locations. However, from offsite locations such as on surrounding roadways in Lanfair Valley, the visual scale of project modifications will be attenuated by distance. Some potential project visual impacts will be moderated by the location of project facilities and by design factors such as contour grading, or reclamation activities such as rock staining and revegetation.

3. The orebodies are beneath a north-south trending drainage. This location will conceal most of the vertical extent of the pit walls behind a ridge, when viewed from the floor of Lanfair Valley to north and west directions. The overburden pile will be on an outwash slope bounded on the east and west flanks by small hills. These hills will partially conceal the

overburden and provide a natural appearing skyline. The heap leach piles will be on lower slopes near the valley floor, southwest of the open pits. This area slopes gently to the southeast. Because the heap leach piles should appear as flat mesas from distant views, they will mimic the natural topography of the valley floor, thereby minimizing potential contrasts in form.

4. The topographic changes will not involve modifications to ridgelines along the crest of the Castle Mountains, which will continue to serve as a backdrop for mining activities that have occurred on the lower flanks of these mountains for many years.

5. The most evident project change as viewed from a distance of three or more miles, may initially be the contrast in color. To reduce this contrast, the upper pit walls will be sprayed with rock staining solutions.

6. Permeon, the material that will be used to stain the upper walls of the mine pits, has been used at other locations. Agencies that have used the rock stain include:

   - Arizona Department of Transportation
   - Bureau of Land Management (CA, AZ, NV, UT)
   - California Department of Transportation
   - U.S. Forest Service
   - Other agencies and private developers
   - Other mining companies

   The RWQCB has reviewed the chemical constituents and determined that they will not be harmful to water quality when appropriate application procedures are followed. Based on previous RWQCB reviews of the chemical constituents, no significant potential for contamination of soils and/or ground water is expected. The anticipated life of the rock staining process is 100(+) years.

7. At project completion, the visual appearance of those areas as viewed from offsite locations will be similar to adjacent rocky and sparsely vegetated slopes. Color contrasts for other areas disturbed by the project will be less than the contrasts presented by the existing clay pits. Fine-textured and highly reflective clay minerals are responsible for the large contrasts between the clay pits and surrounding terrain. Clay minerals are present in the soils and rock that will be disturbed by the project, but in much lower concentrations than in the clay quarries. The color contrasts shown for the overburden and heap piles will be attenuated as vegetation becomes established over these areas.

4.3.4.2 Photograph Simulations

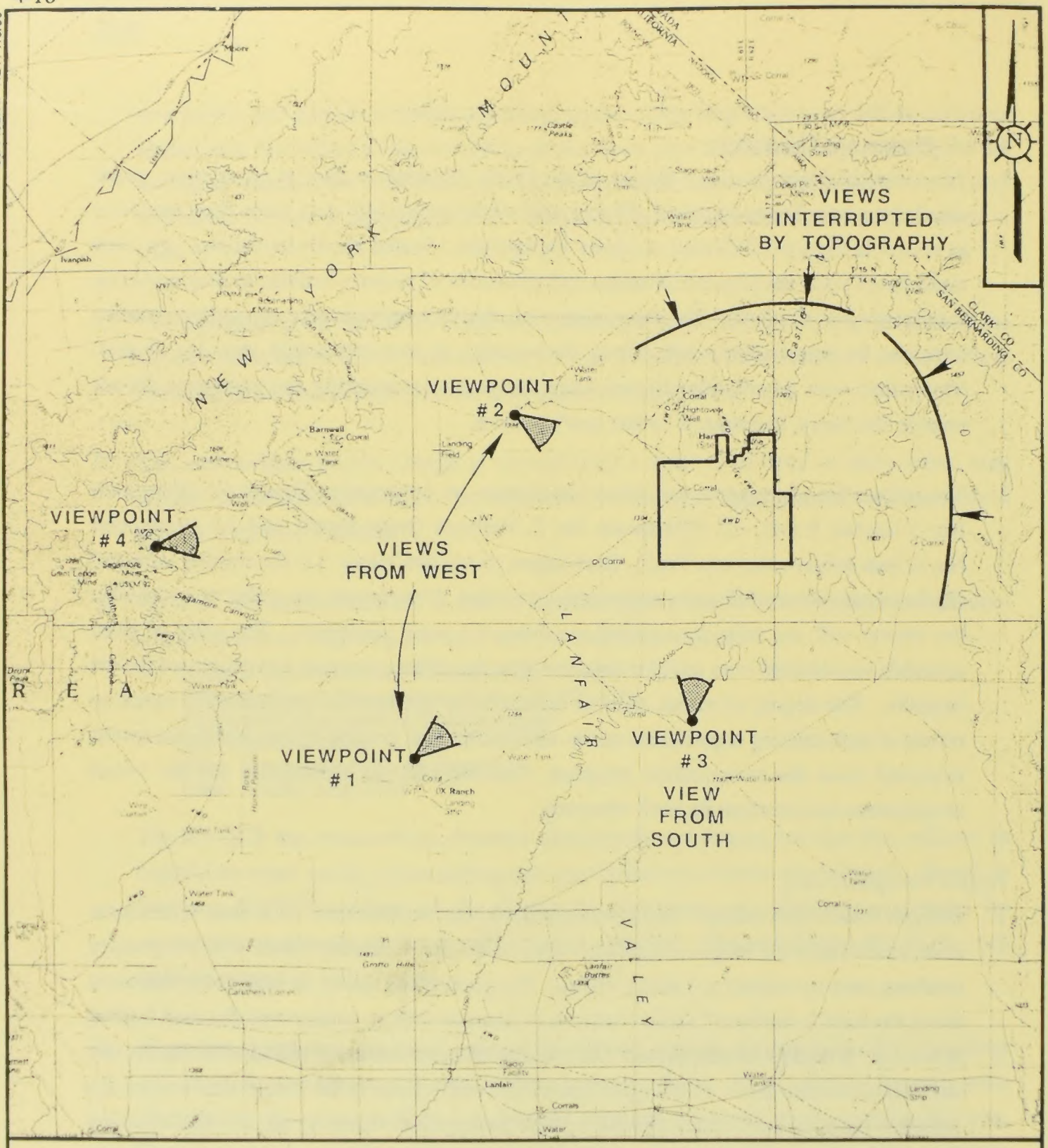
1. To assess the potential visual impact of the Castle Mountain project at completion, visual simulations have been completed. Photographs of the project site were taken from roadways as shown in Figure 4.5 (Visual Analysis Viewpoints). Scaled photo-simulations were then made based upon the planned locations and elevations of project facilities as they would be seen from each viewpoint. The viewpoints were chosen to represent the approximate nearest locations on surrounding roads where the majority of travelers would view the project. Viewpoints were specifically selected where intervening topography and vegetation did not impede site views, to present a "worst case" analysis.

2. The project site photographs and photo-simulations are presented in Figures 4.6 (Viewpoint No. 1 Lanfair Road), 4.7 (Viewpoint No. 2, Railroad Grade Road), and 4.8 (Viewpoint No. 3, East Mojave Heritage Trail). Each figure shows two views: (1) the existing view and (2) the expected view following reclamation activities. Photographs are scaled to depict what the viewer will see with the unaided eye from the same viewpoint. The color of earth materials was derived from samples obtained from the drilling program that delineated the ore deposits. The degree of visual contrast reduction by reclamation procedures is based on results of rock staining experiments onsite, anticipated final grading design, and initial results expected from the revegetation program. Specific changes anticipated for the visual environment are described for each viewpoint.

Project Viewpoint No. 1

1. Ivanpah Road enters Lanfair Valley from the northwest via Barnwell. This road, which turns south and crosses the length of Lanfair Valley, is known as Lanfair Road. It is the primary roadway used by visitors to Lanfair Valley. The photograph shown in Figure 4.6 was taken along this road in northern Lanfair Valley at its junction with an unimproved dirt road leading to the site. It depicts easterly views. The existing visual environment includes the Joshua tree woodland/creosote bush scrub vegetation on the valley floor in the foreground and on the southern flank of the Castle Mountains in the background. Existing human modifications evident in the photograph include the dirt road, and clay pits at the base of the Castle Mountains.

2. At project completion, the upper portions of open pit walls, the overburden pile, and heap leach piles will be visible from this viewpoint. The heap leach piles and overburden pile will form low mesas at the base of the Castle Mountains. Revegetation of overburden and heap



LEGEND

- APPROXIMATE VIEWPOINT LOCATION
- DIRECTION OF VIEW

0 5 MILES

SCALE

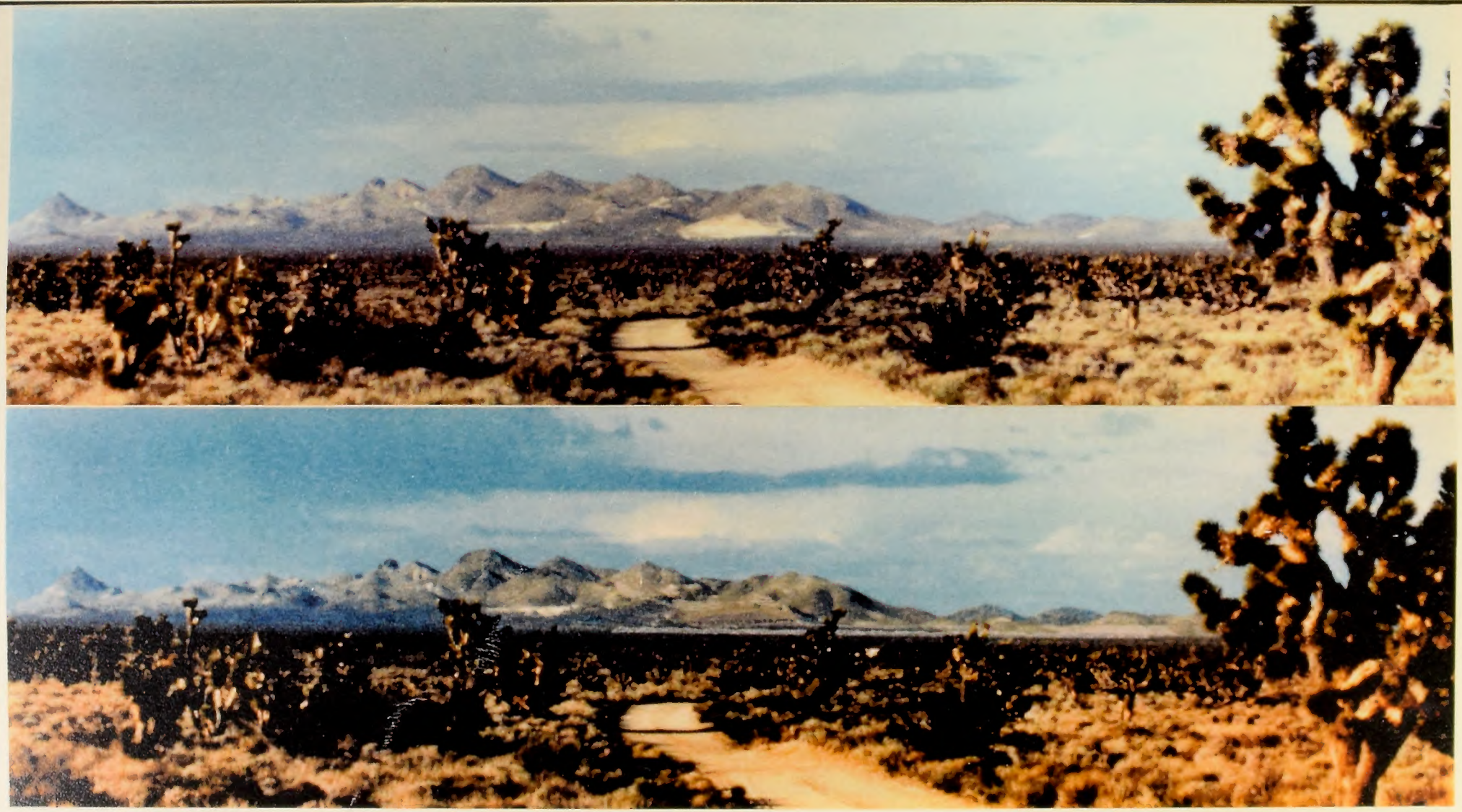
REFERENCE: U.S.G.S. 1:100,000 SERIES TOPOGRAPHIC MAPS OF DAVIS DAM AND IVANPAH

FIGURE 4.5

VISUAL ANALYSIS VIEWPOINTS

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION



EXISTING: (TOP PHOTO)
View northeast from Lanfair Road, about five miles west of the proposed project site. The existing clay pits are visible as light-colored areas (center) against the darker backdrop of the Castle Mountains.

AFTER RECLAMATION: (BOTTOM PHOTO)
Reclamation Procedures including rock staining of upper mine pit walls, grading to reduce straight line geometries, and revegetation would effectively mitigate the potential for strong visual contrasts. Reclamation of the South Clay Pit on Big Chief Hill will improve the existing visual contrasts.

Note:
When held at approximately arm's length distance, photograph scale is representative of an observer's view with unaided eye from the same viewpoint.

FIGURE 4.6

VIEW POINT NO. 1
(LANFAIR ROAD)

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION





EXISTING: (TOP PHOTO)
View southeast from Railroad Grade Road (adjacent to Wilderness Study Area 266) about four miles from the South Clay Pit on Big Chief Hill located at center. Castle Mountains appear at left with Piute Mountains in background. North Clay Pit is at left with former mining and exploration roads above.

AFTER RECLAMATION: (BOTTOM PHOTO)
Reclamation procedures including rock staining of upper pit walls, grading to reduce straight line geometrics, and revegetation would effectively mitigate the potential for strong visual contrasts. Reclamation of the South Clay Pit would result in an overall positive effect to the existing visual contrasts.

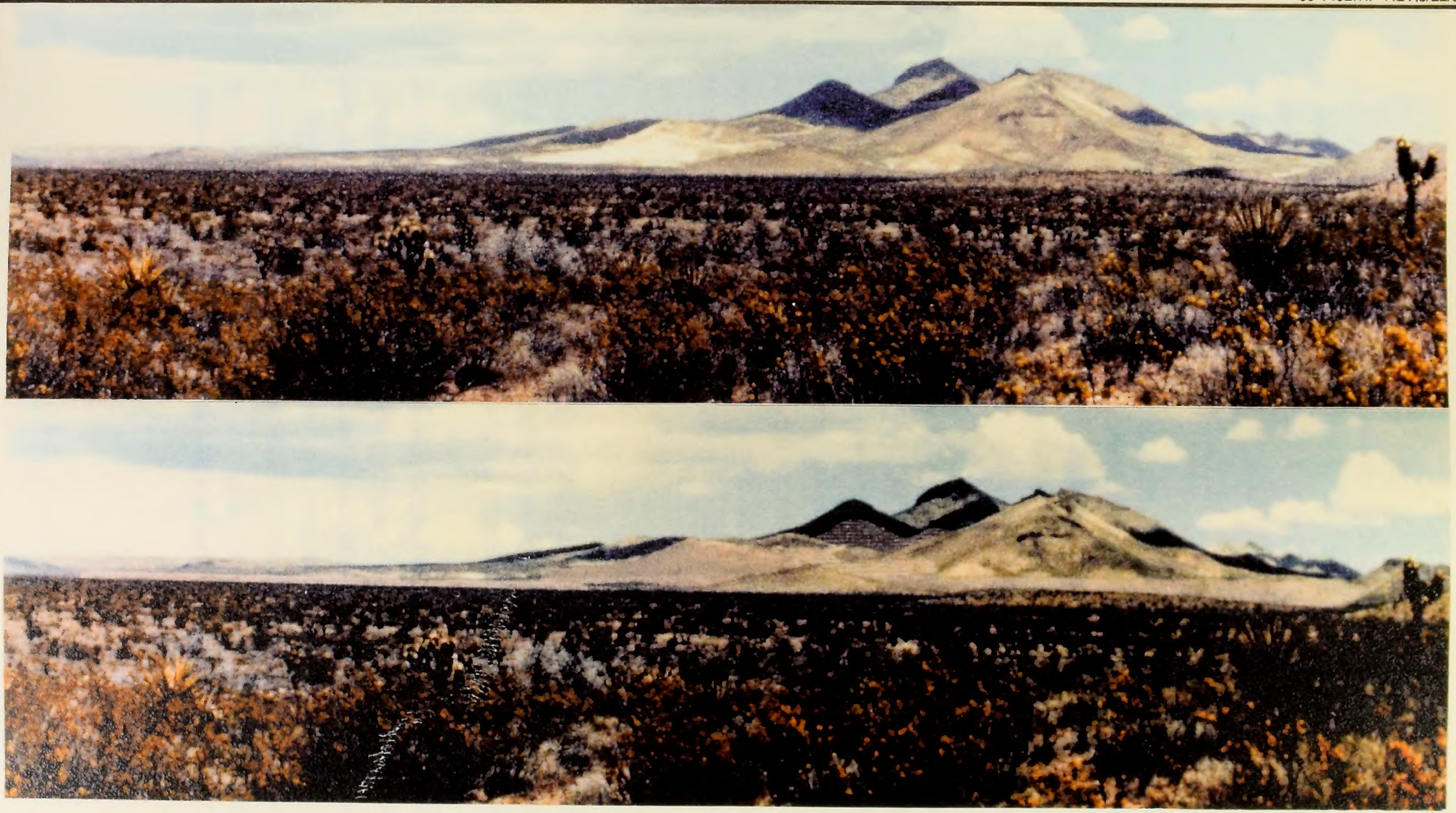
Note:
When held at approximately arm's length distance, photograph scale is representative of an observer's view with unaided eye from the same viewpoint.

FIGURE 4.7

VIEWPOINT NO. 2 (RAILROAD GRADE ROAD)

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION



EXISTING: (TOP PHOTO)
View north from East Mojave Heritage Trail (about three miles from project site) towards southern limits of Castle Mountains. South Clay Pit on Big Chief Hill is at center. Clouds shadow upper slopes and canyons.

AFTER RECLAMATION: (BOTTOM PHOTO)
Reclamation procedures including rock staining of upper pit walls, grading to reduce straight line geometrics, and revegetation would effectively mitigate the potential for strong visual contrasts. Reclamation of the South Clay Pit would result in an overall positive effect to the existing visual contrasts.

Note:
When held at approximately arm's length distance, photograph scale is representative of an observer's view with unaided eye from the same viewpoint.

FIGURE 4.8

VIEW POINT NO. 3
(EAST MOJAVE HERITAGE TRAIL)

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

piles in accordance with the reclamation plan will reduce the initial color contrasts. Application of rock staining solutions to darken the upper walls of mine pits will reduce contrast with adjacent slopes. The South Clay Pit on Big Chief Hill will be reclaimed with overburden on the lower slopes and rock staining on the upper pit wall.

Project Viewpoint No. 2

1. As shown in Figure 4.7, from the northwest, foreground views are dominated by northern Lanfair Valley with Joshua tree woodland. Background views include the southwestern flank of the Castle Mountains, with the Piute Range forming the distant skyline. Visible existing modifications on the project site include the clay pits, particularly the South Clay Pit, and access roads to sites associated with exploration and previous mining activities.

2. Elements of the completed project visible from this location will include the upper limits of the Lesley Ann and Oro Belle Pit walls and the heap piles. The pit walls will initially appear as lighter colored rock which will contrast with the darker slopes of the Castle Mountains. Heap Leach Piles will appear as low mesas similar to the distant outline of the Piute Range. Initial color contrasts will be reduced with revegetation of overburden and heap piles, and application of rock staining solutions to upper pit walls. As from Viewpoint No. 1, these reclamation measures will have a pronounced mitigating effect upon visual aspects for the South Clay Pit Reclamation Area.

Project Viewpoint No. 3

1. Views from the south in the vicinity of the East Mojave Heritage Trail encompass creosote bush scrub community on the valley floor and along the southern limits of the Castle Mountains. The existing South Clay Pit is the most prominent disturbance visible.

2. As shown in Figure 4.8, the overburden pile and the south-facing slopes of the open pits will be visible from this southerly direction. The overburden pile will form a mesa on an outwash plain bounded by small hills. The heap leach piles will form low mesas below the similarly configured horizon. Portions of the Lesley Ann and Oro Belle upper pit walls will be visible against the slopes of the Castle Mountains. Color contrasts will be reduced with revegetation and application of rock staining solutions. The South Clay Pit will be reclaimed with overburden on the lower slopes and rock staining on the upper pit wall.

4.3.4.3 Topographic Model

1. Viceroy has constructed a topographic model of the project site at a scale of one inch equaling 500 feet. The model allows viewers to position themselves at various locations in Lanfair Valley, relative to the project site, enabling them to better assess the visual impact on topographic features caused by project development.

2. The model shows the location and relative size of the mine pits, overburden disposal area, leach pads, and the South Clay Pit Reclamation Area, as those areas will appear after the project has ended and reclamation has been completed.

3. A comparison of the view of the project site from the New York Mountains is presented in Figure 4.9 (New York Mountains Viewpoint). The upper picture is a photograph of the project site as it exists today looking east from New York Mountain, a distance of about 10 miles across Lanfair Valley. The Castle Mountains dominate the middle view and the darker colored Piute Range can be seen further in the distance, to the right of the Castle Mountains. The North and South Clay Pits are readily visible at the base of the Castle Mountains. The lower picture is a photograph of the topographic model, with the camera placed in the same relative position as the upper photograph. The view shows the South and North Clay Pits as reclaimed and unreclaimed, respectively.

4.3.4.4 Visual Impacts After Reclamation

1. Measures that Viceroy will use to reduce the potential visual contrasts to land surface and vegetation include:

   - Contouring of Overburden and Heap Leach Piles to reduce potential contrast in form and line.
   - A revegetation program using plant species common to the area. Revegetation will reduce the color contrast of the overburden pile and heap leach pile. The program will be developed and implemented using the results of a Revegetation Research Program that will investigate and evaluate various procedures to achieve successful revegetation results in the desert environment.
   - Rock staining solutions will be applied to rock wall surfaces in the upper portions of the mine pits and South Clay Pit. Rock staining, as shown in Figure 4.10 (Examples of Rock Staining), will reduce the contrast between the pit walls and the surrounding undisturbed slopes by darkening rock surfaces exposed by activities such as road cuts and mining excavations.



TOPOGRAPHIC MODEL:
The photograph above displays the extent to which topographic changes associated with the Castle Mountain Project will be visible from the New York Mountains at the conclustion of the project. It gives effect to the reclamation of the heap leach pads, overburen desposal site, the Lesley Ann and Oro Belle Pits, most onsite roads, and the South Clay Pit. In April, 1990, Viceroy reached an agreement in principle to purchase the North Clay Pit and surrouning acreage. Accordingly, as the topographic model was constructed several months earlier, the North Clay Pit was shown on the model as it presently appears (i.e., prior to reclamation).



EXISTING:
Easterly view from the New York Mountains across Lanfair Valley to the Castle Mountains, about 10 miles away. The existing clay pits are visible as light-colored areas at the base of the Castle Mountains. The South Clay Pit occupies the upper central portion of the photograph, at the base of Big Chief Hill. The North Clay Pit is also visible, about 8/10 of a mile north (left) of the South Clay Pit. Roads associated with historic mining activities and recent exploration work are visible on the hillsides between the two clay pits. The Piute Range is on the horizon in the upper right third of the photograph.

FIGURE 4.9

NEW YORK MOUNTAINS VIEWPOINT

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

88-148B/RP REV.5/22/90

136391



PHOTO 1: Staining on rock cut at highway widening project near Palm Desert, Riverside County. Widening left a large, white colored rock wall. Upper portion of the wall has been treated with staining to replicate "desert varnish" appearance of adjacent areas.



PHOTO 2: Staining on rock cut on exploration drill road at Castle Mountain Project. Excavation exposed light colored rock, the right half of which has been stained to resemble rock outcrop on ridge above and to the left of the road.

FIGURE 4.10

EXAMPLES OF ROCK STAINING

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

2. Viceroy has acquired ownership of the South Clay Pit on Big Chief Hill and will reclaim this existing feature as part of its reclamation program.

3. As previously disclosed, an agreement in principle has been reached to purchase the North Clay Pit. If this agreement is finalized, Viceroy will reclaim the North Clay Pit using procedures similar to those to be used on the South Clay Pit.

4.3.4.5 Conclusion

1. Based upon the reclamation procedures shown in the photo simulations, distant views of the natural environment from surrounding roadways will not be significantly affected, because the scale of project elements will be subordinate to the natural landscape. Overburden and Heap Leach Piles when viewed from the northwest, west, and south will resemble low mesas generally compatible with the surrounding natural topography. The form of these elements will not interrupt the dominant background ridgelines of the Castle Mountains and Piute Range.

2. Reclamation of the South Clay Pit will contribute to a substantial visual enhancement of the area.

4.4 GEOLOGIC SETTING

4.4.1 PHYSIOGRAPHY

1. The southern flank of the Castle Mountains represents a highly degraded volcanic center of a caldera of Miocene age (Jennings, 1961). Lanfair Valley, an extensive, low-relief area of about 340 square miles, lies immediately south and west of the project site. Surface waters (which occur only after precipitation events) drain south into Fenner Valley, except for small drainages through the Piute Gorge to the east and Cedar Wash to the west. The project's West Well Field lies about two miles northwest of the mining area, on the alluviated floor of Lanfair Valley.

2. Lanfair Valley is rimmed by mountain ranges and prominent hills that vary from very low to very high relief. To the north lie the Castle Peaks and Castle Mountains. To the west lie the Mid Hills and New York Mountains that attain elevations of 7,500 feet. The easterly boundary is formed by the relatively narrow and linear, moderate-relief Piute Range. The

south margin of the valley is bordered by three main low- to moderate-relief uplands separated by alluviated drainage channels. Topographically, the surface of Lanfair Valley lies above the surrounding valleys.

4.4.2 GEOLOGY

1. The Castle Mountains and other ranges surrounding Lanfair Valley have been uplifted relative to the adjoining basins, presumably along faults that now lie buried beneath the basin fill. Although the origins of the mountains are structurally similar, the rocks that compose them are not. Recent alluvium has filled Lanfair Valley. Older alluvium of Pleistocene age is exposed along the northwest valley perimeter and represents earlier stages of alluvium. Calichefied (calcium carbonate) soils have discontinuously developed within the near surface of both the older and younger alluvial deposits, forming a relatively resistant mantle.

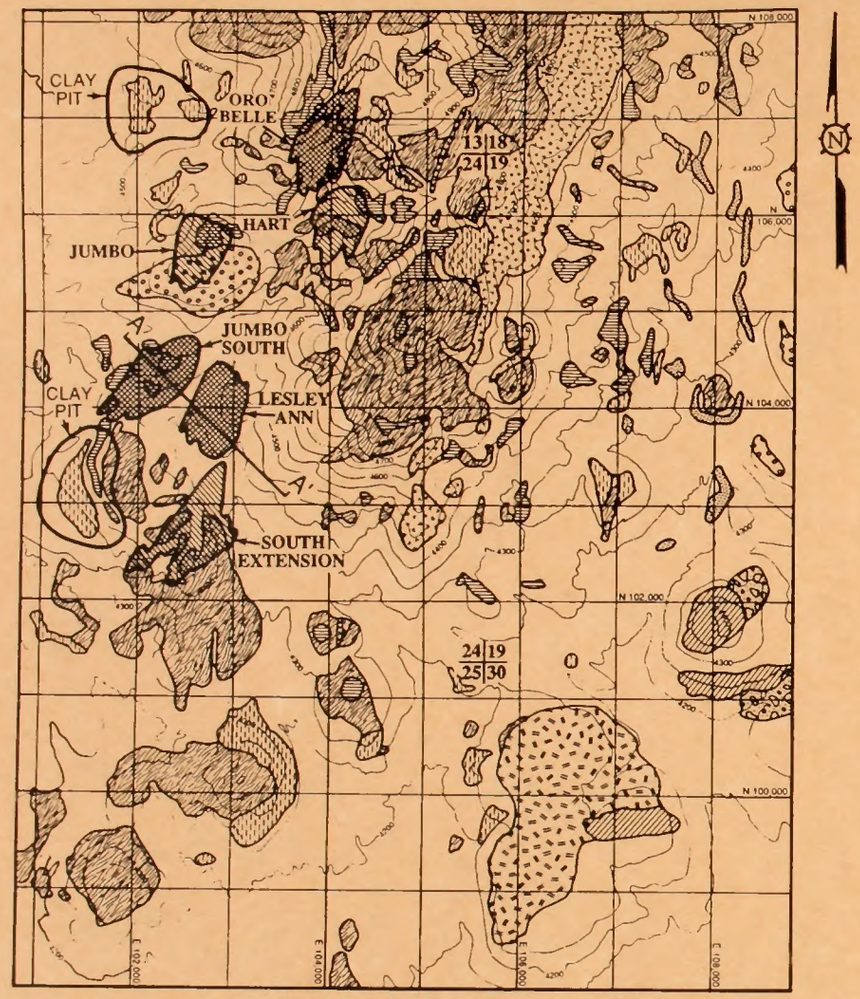
2. Numerous faults have been mapped in the Castle Mountains and around Lanfair Valley, although the level of faulting is not more pronounced in this region than in other portions of the Great Basin. Most of the mapped faults are confined to the uplands where bedrock is exposed. Faults also may underlie the basin areas, but are nondetectable because of the alluvial cover. Active faults have been not delineated in the project area (Jennings, 1975; Longwell *et al*, 1965; Wesnoustry, 1986). The closest known active fault is the Mannix Fault, 72 miles west of the project site.

3. The Castle Mountains, like many ranges in the Mojave Desert, are composed of a Proterozoic basement unconformably overlain by Tertiary volcanic and sedimentary rocks as shown in Figure 4.11 (Site Area Geology and Cross Section A-A). The Tertiary rocks in the Castle Mountains are subdivided into pre- and post-mineralization groups. Preliminary age dating results suggest that the Tertiary volcanics range in age from 13 to 22 million years ago and that mineralizing events occurred about 15 million years ago in mid-Miocene time.

4.4.3 ORE DEPOSITS

1. The primary mineralized area in the Castle Mountains is ringed by the rim of a small caldera about five miles in diameter, as evidenced by a series of arcuate silicified fractures located along the rim of the caldera. Within this mineralized zone, gold is the major metal, as the silver content is low, and base metals are nonexistent. Most mineralization is very

88-148RP/REV. 7/25/90



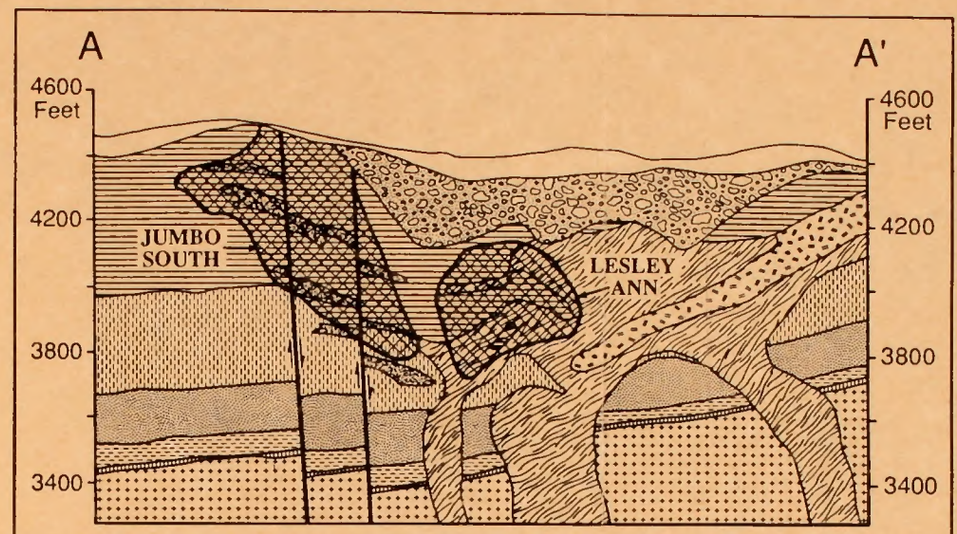
EXPLANATION

TERTIARY POST-MINERALIZATION VOLCANICS
- PIUTE BASALT AND ANDESITE
- PIUTE LAHAR
- ANDESITE INTRUSIVE
- PORPHYRITIC RHYOLITE
- POORLY CONSOLIDATED GRAVEL

TERTIARY PRE- AND SYN-MINERALIZATION VOLCANICS
- RHYOLITE BRECCIA
- RHYOLITE FLOWS AND INTRUSIVES
- HETEROLITHIC TUFF
- ANDESITES (AND RELATED SEDIMENTS)

- CLAY PIT
- ORE BODY

0 1000 2000 3000 FEET
SCALE



EXPLANATION

QUATERNARY
- ALLUVIUM

TERTIARY POST-MINERALIZATION SEDIMENTS
- POORLY CONSOLIDATED GRAVEL

- ORE BODY

TERTIARY PRE- AND SYN-MINERALIZATION VOLCANICS
- HYDROTHERMAL BRECCIA
- RHYOLITE BRECCIA
- RHYOLITE FLOWS AND INTRUSIVES
- PORPHYRITIC RHYOLITE
- HETEROLITHIC TUFF
- ANDESITES (AND RELATED SEDIMENTS)
- WELDED TUFF
- CONGLOMERATE

PRECAMBRIAN
- SCHIST AND GNEISS

0 500 1000 FEET
SCALE

FIGURE 4.11

SITE AREA GEOLOGY AND CROSS SECTION A-A'

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

fine-grained, although coarse gold has been encountered in some areas. The gold is associated with zones of higher permeability, as it occurs mainly within small quartz veins and fractures or in silicified breccias.

2. Gold mineralization is widespread over an area of at least two square miles and a vertical range of more than 1,500 feet, as proven by drilling and old workings. The Castle Mountain orebodies can be classified as volcanic-hosted epithermal-type mineralization. The overall gold to silver ratio is about 1:2, but in the core of the Jumbo South, Lesley Ann, and Oro Belle deposits the ratio is 2:1.

3. The project's known ore reserves are found in orebodies identified as the Lesley Ann/Jumbo and Oro Belle deposits. Silicified zones, associated with higher gold grades, outcrop at the Oro Belle deposit. Near surface, coarse gold found in veins was mined in the early 1900s. The mining was short-lived, however, as the veins diminished with depth. Some coarse gold can still be found in shallow underground workings of the Oro Belle deposit, and minor visible gold is found in drill cuttings and core. The three deposits are expected to contain at least 30 million tons of mineable ore.

4. In general, the Castle Mountain orebodies are associated with brittle, well-fractured, and brecciated rock units. Significant amounts of mineralization occur in all of the pre-mineralization Tertiary rock units, but the rhyolite flow-dome complexes and associated breccias are more likely to contain important amounts of mineralization than are the lithic tuffs.

5. Mineralization was first thought to be controlled by a few north-northeast-trending, steeply east-dipping silicified zones which form prominent outcrops, as at the Oro Belle deposit. However, most reserves are in the relatively flat-lying, thick, and laterally extensive Jumbo South and Lesley Ann deposits.

6. In detail, mineralization occurs chiefly in small hematitic, vuggy quartz veins and fractures or in silicified breccias. Most mineralization is very fine-grained and is not visible to the naked eye. Gold occurs as relatively pure grains and as electrum. These grains are usually associated with hematite within remnant pyrite cavities. Metallurgical tests show that the mineralization is amenable to treatment by conventional heap leaching methods.

7. Silicification and argillization are the two common forms of alteration which are prevalent in and around the Castle Mountain deposits. Gold is closely associated with silicification, which occurs pervasively and as numerous small chalcedonic veins and fracture fillings. Some of the best mineralization occurs in relatively small zones of hydrothermal breccia. Mineralized rocks are generally bleached and show highly variable argillic alteration. Hydrothermal clay alteration (sericite-illite) taken from an underground working within the Jumbo South deposit yielded a K-Ar date of 14.9 ± 0.3 million years ago. The two commercial clay pits immediately west of the gold deposits are probably part of a large scale alteration zoning pattern, but the geological details are not yet known.

4.4.4 SOILS INVENTORY

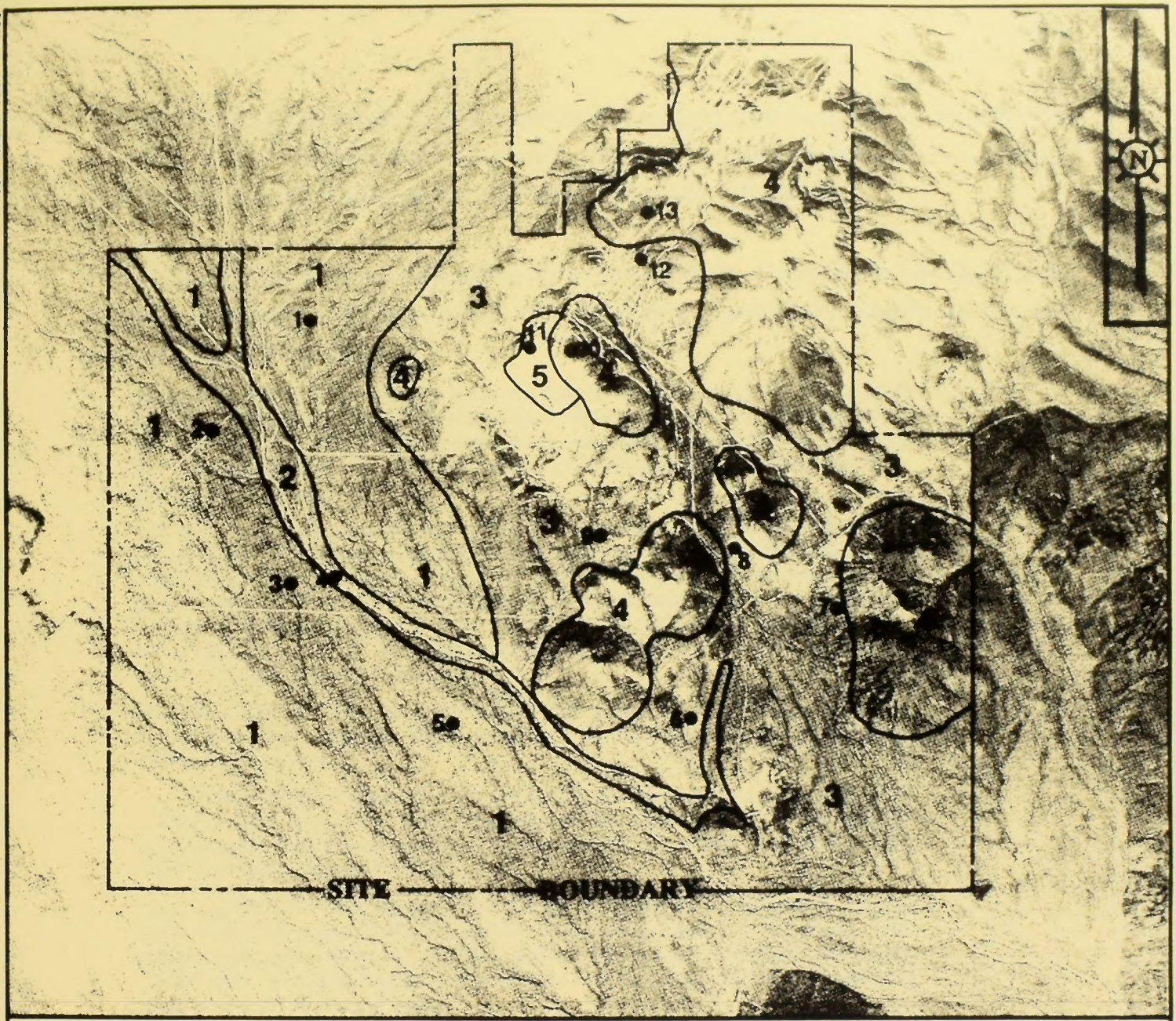
1. In general, area soils are fairly shallow, as is typical of desert soils. These soils are formed on recent alluvial fans which were derived from Tertiary volcanics. Textural classes range from sands to clays. Soils are shallower along upper slopes and fans, and deeper on lower terraces and drainage bottoms.

2. A soil survey was conducted at the project site by Greystone Development Consultants, Inc., to determine salvageable depths of soil material suitable for reclamation. The soil survey, a copy of which is attached as Appendix F: Soil Survey for the Castle Mountain Project, was designed and conducted to be consistent with the National Cooperative Soil Survey. Generally, the project site soil survey consisted of soil mapping and field reconnaissance within the areas proposed for surface disturbance, soil sampling and analysis, and suitability determinations for growth media salvage.

3. The soil mapping unit boundaries, as well as soil sample site locations are shown in Figure 4.12 (Soil Mapping Units and Test Pit Locations).

4. Each collected soil sample was analyzed for the following parameters: pH, particle size (texture), saturation percentage, conductivity, soluble calcium, magnesium, and sodium, sodium adsorption ratio, and organic matter. Nitrogen, phosphorus, and potassium levels were also determined. Laboratory analyses were performed in accordance with standard procedures.

88-148B/RP REV. 4/24/90



LEGEND

2 SOIL MAPPING UNIT

2● TEST PIT LOCATION

0 .5 1 MILE

SCALE

FIGURE 4.12

SOIL MAPPING UNITS AND TEST PIT LOCATIONS

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

5. The soil mapping, profile descriptions and sample analysis data were used to describe the suitability of each mapping unit for salvage. Chemical suitability criteria used were those identified in Table 4.2 (Unsuitability Criteria for Soil or Soil Substitutes).

6. Five basic mapping units were identified on the site based on similarities in salvageable soil depths and chemical characteristics. The following descriptions outline the general characteristics of these units:

   - **Mapping Unit 1** - This mapping unit occurs on the gently sloping and nearly level lands in the western portion of the permit area. Slopes range from zero to 10 percent. Primarily this unit contains the gravelly sandy loam and the cobbly loam soil types that were described earlier. The predominant type is the gravelly sandy loam, but other types occur as inclusions.

     The soil in this unit generally has a gravelly sandy loam surface layer two to eight inches thick. Sixty to ninety percent of the soil surface is covered with gravel. The next horizon is a sandy loam or loam, 12 to 18 inches thick with moderate to high gravel content. This is followed by a light colored layer which is very firm and high in calcium carbonate. Texture in this layer ranges from a clay loam to sandy loam. This is underlain by a layer of loamy sand approximately 12 to 24 inches thick which is, in turn, underlain by alluvial bedrock.

   - **Mapping Unit 2** - This mapping unit occurs within the major drainages of the permit area. It is composed almost exclusively of the Riverwash soil that can vary considerably in texture.

     The soil in this type is generally very sandy. The surface layer is a loose sand about 12 inches thick with many stony fragments on the surface. This is underlain by approximately four feet of very gravelly coarse sand over a very hard, white rocky material at approximately 60 inches.

   - **Mapping Unit 3** - This mapping unit occurs on the gently to moderately sloping lands at the foot of the Castle Mountains. Slopes range from 5 to 25 percent. The primary soil types within this mapping unit are the volcanic slope soil and coarse shallow soil. Minor soil types in this unit are rock outcrops, cobbly silt loam, and small areas of the other soil types.

     The soil in this unit generally has a very gravelly surface and a gravelly loam surface layer 6 to 12 inches thick. This is underlain by another layer of very gravelly loam, 12 to 24 inches thick, which overlays a white rocky substrate.

   - **Mapping Unit 4** - This mapping unit occurs on the steep to very steep slopes of the Castle Mountains. Slopes range from 15 to 75 percent. The unit is composed of the coarse shallow soil and up to 70 percent rock outcrops.

     Much of this unit has no measurable soil cover. Where soils exist, there is generally a loam to silty loam surface layer 4 to 12 inches thick over rock.

   - **Mapping Unit 5** - This area is located where the current clay quarry exists. It has been previously disturbed and, therefore, has no soil.

7. With a few exceptions, the chemical characteristics of the samples collected on the project site are within acceptable limits for topsoil material. Soils are moderately alkaline, and only one sample exhibited even marginal salinity. Pit 1 (25-31) had an electrical conductivity (EC) of

TABLE 4.2

UNSUITABILITY CRITERIA FOR SOIL OR SOIL SUBSTITUTES

PARAMETER	SUSPECT LEVEL(1)
pH	<5.5
Conductivity (mmhos/cm) - Surface - Subsurface	 >4.0 >4.0 - 8.0(2)
Saturation Percentage	>85% <25%
Sodium Absorption Ratio	>15.0
Textural Class	c, sc, sic, cl(735% c), sicl (>35% c, <15% s), sil (<15% s), si, ls, s
Coarse Fragments - Surface - Subsurface	 >20%(3) >35%(3)

88-148B (7/26/90)

(1) The suspect levels are used as a guide in evaluating the suitability of a soil material for reclamation. An evaluation should take into account the "total system." Interactive parameters may either nullify or verify the significance of a potential problem.

(2) The actual maximum acceptable salt level will depend on the plant species proposed in the revegetation plan and the potential for upward salt movement.

(3) The values may vary depending upon the plant species proposed for revegetation in specific locations (e.g., a soil with a very high coarse fragment content throughout its profile may be completely salvaged if used for certain shrub or tree plantings).

7.3 mmhos/cm. Three samples exhibited sodium absorption ratios (SARs) greater than 15.0 in subsoil layers. These three horizons were high in clay content, indicating that sodium is present in the project soil environment and is held by clay particles.

8. The physical parameters evaluated focused primarily on textural analysis. Textures varied from sand to clay. Nearly all of the soils present in the project area are gravelly and have a moderately high gravel content. While most of the soils exceed the general coarse fragment content limits, they are the best material available onsite for use as growth media during reclamation.

9. The soil types have the following range, average salvageable depths, and approximate acreage within areas to be disturbed during development of the project:

	Range (inches)	Average (inches)	Acres Disturbed
Mapping Unit 1	12 to 30	18	317
Mapping Unit 2	8 to 16	12	0
Mapping Unit 3	6 to 12	8	296
Mapping Unit 4	0 to 6	0	165
Mapping Unit 5	0	0	22

4.5 WATER RESOURCES

4.5.1 SURFACE WATER

1. Lanfair Valley is a semi-enclosed, 340-square mile surface water drainage area surrounded by mountains or areas of high bedrock, except for several water gaps. The valley floor is elevated relative to the adjacent Piute, Ivanpah, and Fenner Valleys, apparently the result of alluvial backfilling within the surrounding areas of high bedrock.

2. Streams (washes) within the valley are ephemeral and flow only in direct response to precipitation or snow melt. The stream flow directions, shown in Figure 4.13 (Lanfair Valley Surface Water Drainage) divide the valley into three surface drainage areas, designated as the southwestern, northeastern, and Piute Gorge watersheds. The southwestern watershed covers an area of approximately 95 square miles. The 240-square mile northeastern watershed encompasses the major portion of Lanfair Valley and includes the Castle Mountain Project site and well field. Surface water in this watershed generally flows toward the southeast in several unnamed washes. The Piute Gorge watershed is only about five square

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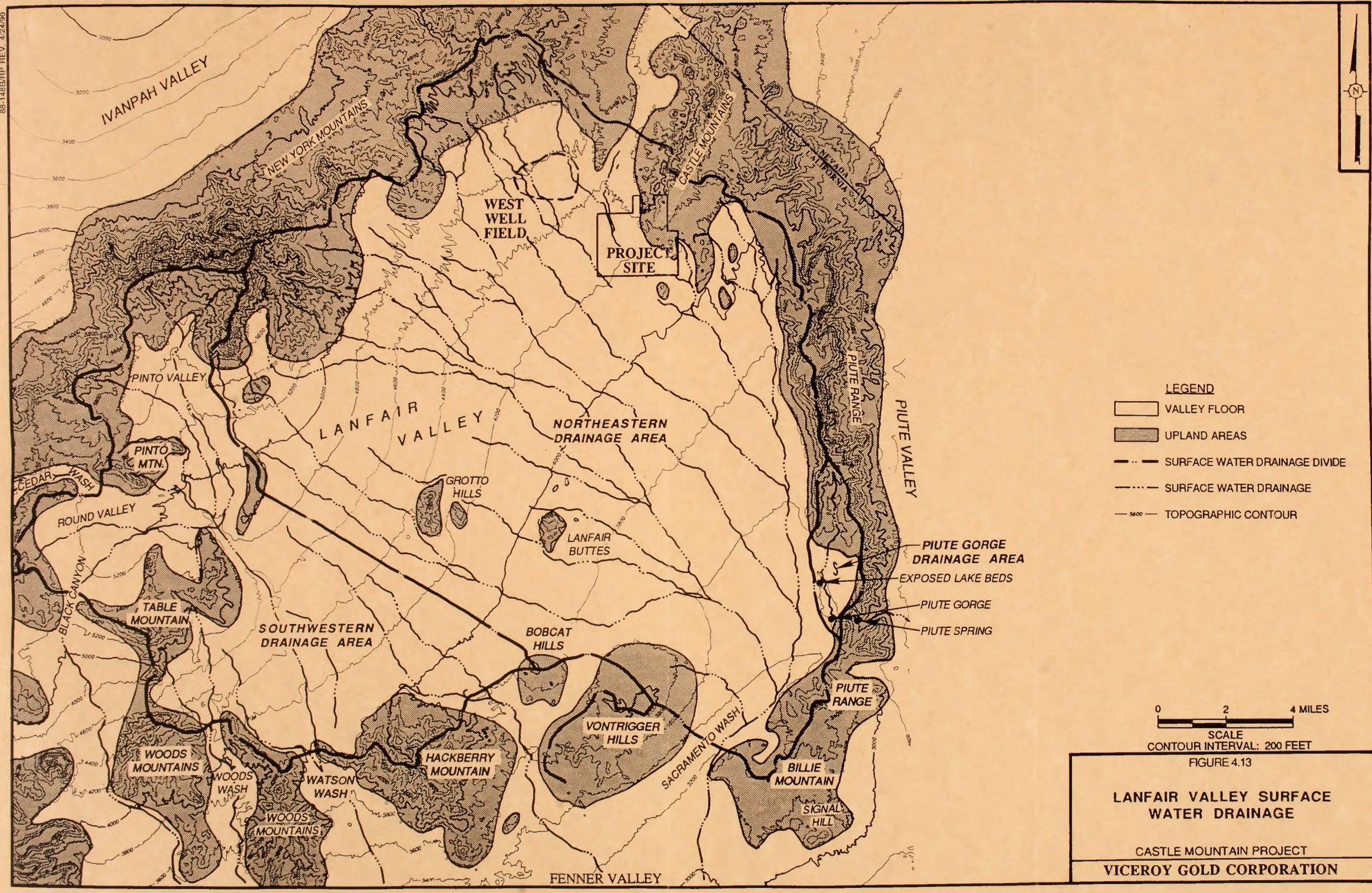


FIGURE 4.13

LANFAIR VALLEY SURFACE WATER DRAINAGE

CASTLE MOUNTAIN PROJECT

VICEROY GOLD CORPORATION

miles in size. This relatively small area discharges into a deeply incised (1.5- by 0.5-mile) gorge eroded into the alluvium, which then drains into a bedrock canyon through the Piute Range toward Piute Spring.

3. The project site is crossed by a number of dry washes, as shown in Figure 4.14 (Project Site Surface Water Drainage). These washes form a small part of the network of washes making up the northeastern drainage system within Lanfair Valley. The dry washes traversing the site carry water only in response to the infrequent large storms that pass through the area. Estimated peak flows at various locations within the site boundary due to a 24-hour storm event with a return period of 100 years are shown in Figure 4.14. The flood plain resulting from the 24-hour storm event is also shown.

4.5.2 GROUND WATER

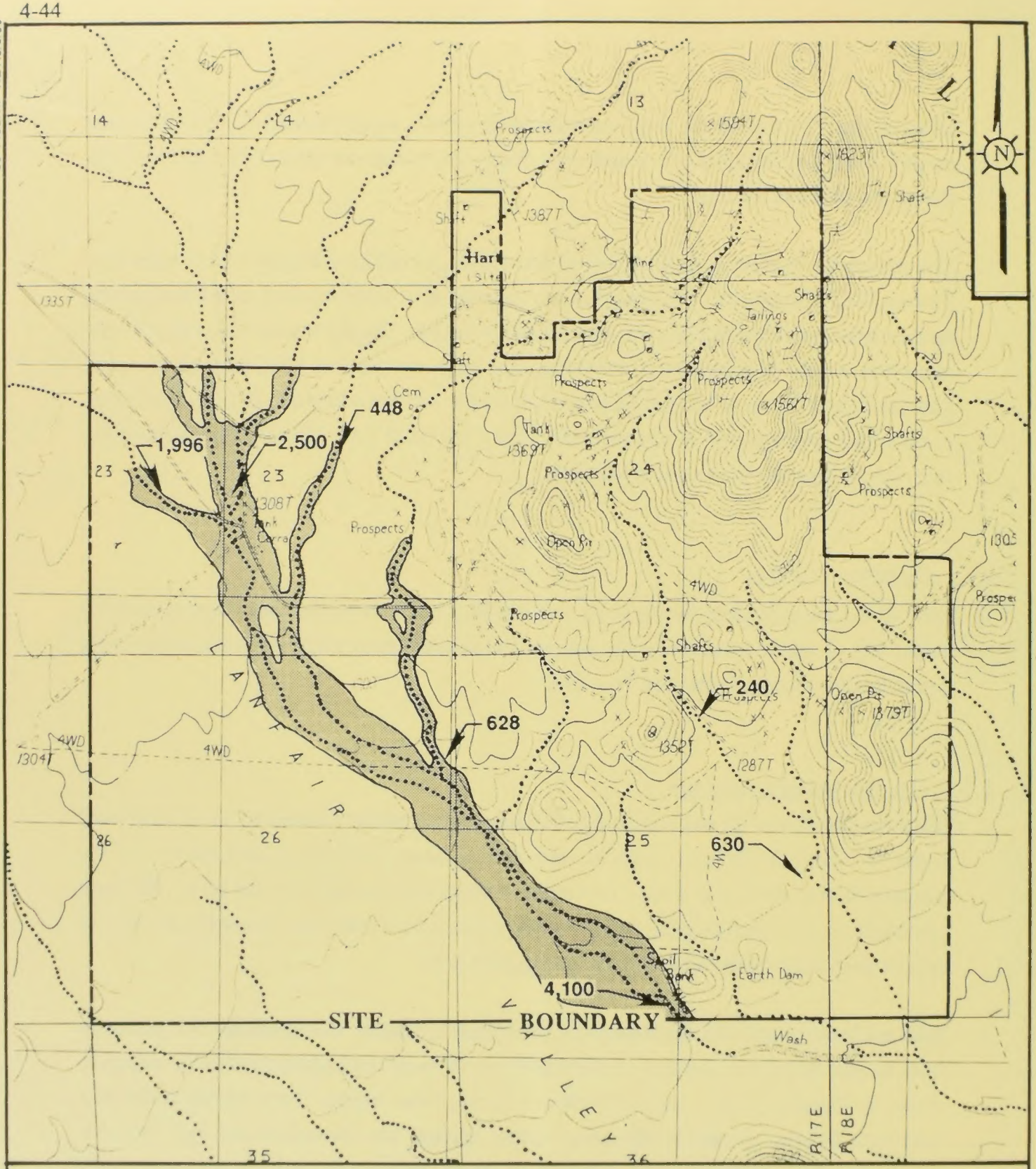
1. Most of the water required for the project will be obtained from wells in alluvium at the West Well Field. A minor amount of water may also be obtained from wells within the project area, designated by Viceroy as the East Well Field.

4.5.2.1 Lanfair Valley Conditions

1. Unconsolidated alluvial and colluvial soils represent the primary source of potential ground water in Lanfair Valley. Aquifer test data indicate that the transmissivity of the unconsolidated material is at least one order of magnitude greater than the rock. The rock surrounding and underlying the valley may be suitable for small domestic wells, but not for the relatively high yields required for a mining operation.

2. Data available to describe hydrogeologic conditions in Lanfair Valley are derived primarily from springs in the area and from wells which have been drilled and reported in the valley, as shown in Figure 4.15 (Location of Well and Spring Data Points). Piute Spring is the only perennial flowing stream in the area. Other springs are located in the high bedrock surrounding Lanfair Valley and generally have small, intermittent flows during wet periods.

88-148B/RP REV. 5/8/90



LEGEND

- 100 YEAR FLOOD PLAIN
- ..... INTERMITTENT STREAM BED
- 630 EPHEMERAL STREAM FLOWS DUE TO 24-HOUR, 100-YEAR FLOOD EVENT (CUBIC FEET/SECOND)

REFERENCE: 7.5 MINUTE U.S.G.S. TOPOGRAPHIC MAPS OF HART PEAK, CALIFORNIA-NEVADA, AND CASTLE PEAKS, CALIFORNIA. DATED: 1984

0 .5 1 MILE

SCALE

FIGURE 4.14

PROJECT SITE SURFACE WATER DRAINAGE

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98-148B/RP REV. 4/24/90

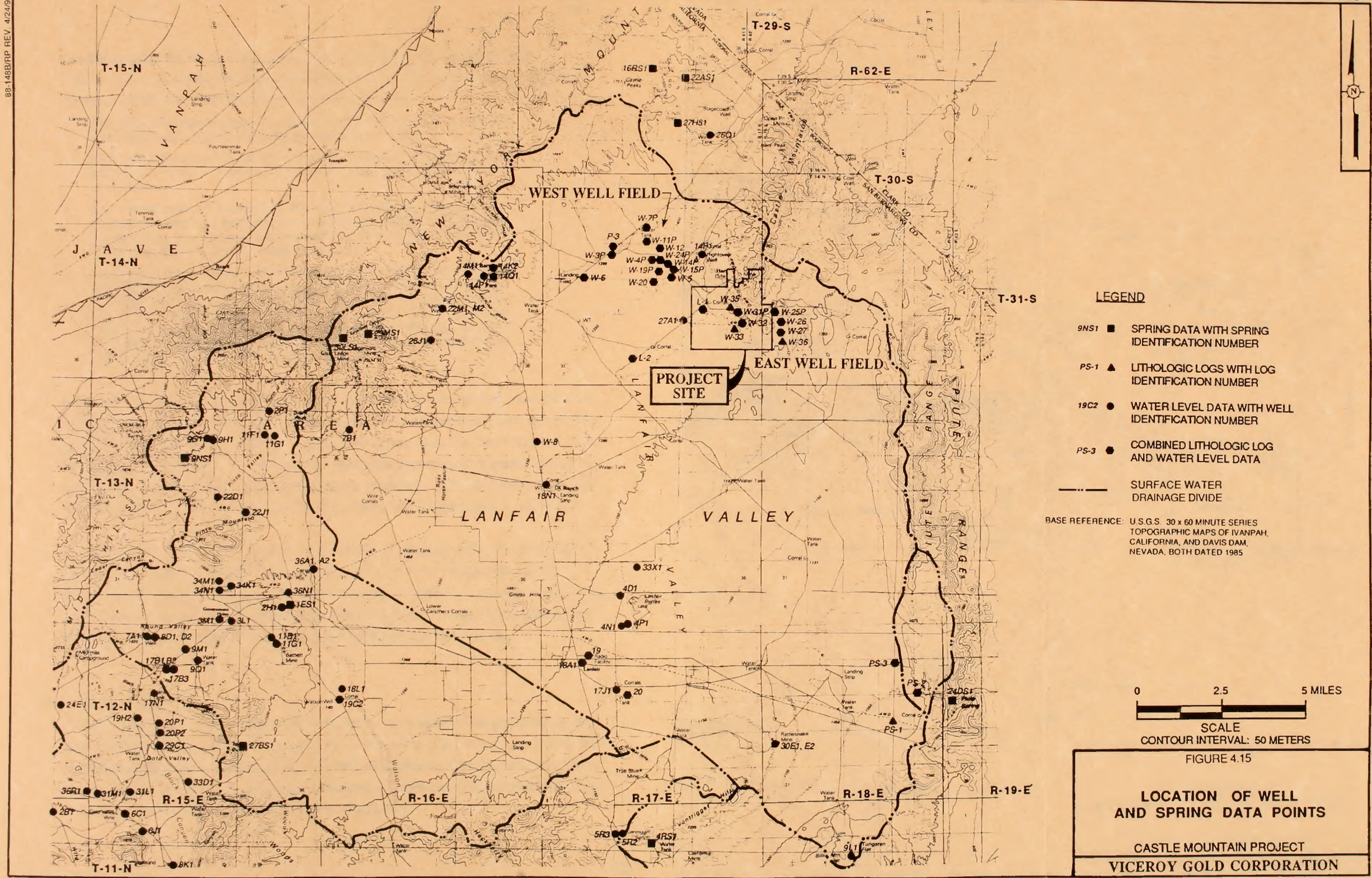


FIGURE 4.15

LOCATION OF WELL AND SPRING DATA POINTS

CASTLE MOUNTAIN PROJECT

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Conditions across the valley, as interpreted from the available data, are illustrated in Figure 4.16 (Lanfair Valley Hydrogeologic Cross Section). The unconsolidated valley fill in the vicinity of the West Well Field is characterized as follows:

- The valley fill materials vary from gravel to clay and at some locations are interbedded with volcanics extending to depths of 1,125 feet.
- Hydrogeologic properties of the valley fill materials vary vertically and horizontally because of the variability of material types and the existence of volcanics.
- The overall saturated thickness in the well field is greater than 700 feet, although the effective thickness from a water availability viewpoint may be somewhat less, because the interbedded volcanic zones have much lower transmissivity than the sands and gravels.
- A persistent confining layer in the alluvium is not evident from either the well log data or the interpretation of geologic conditions in the valley. However, short-term aquifer test results indicate that the aquifer initially serves as a confined system when pumping is started. The Mark Group (1988) interprets this condition to be a result of the interbedded nature of the materials and concludes that under actual well field conditions, the aquifer would function as an unconfined system.

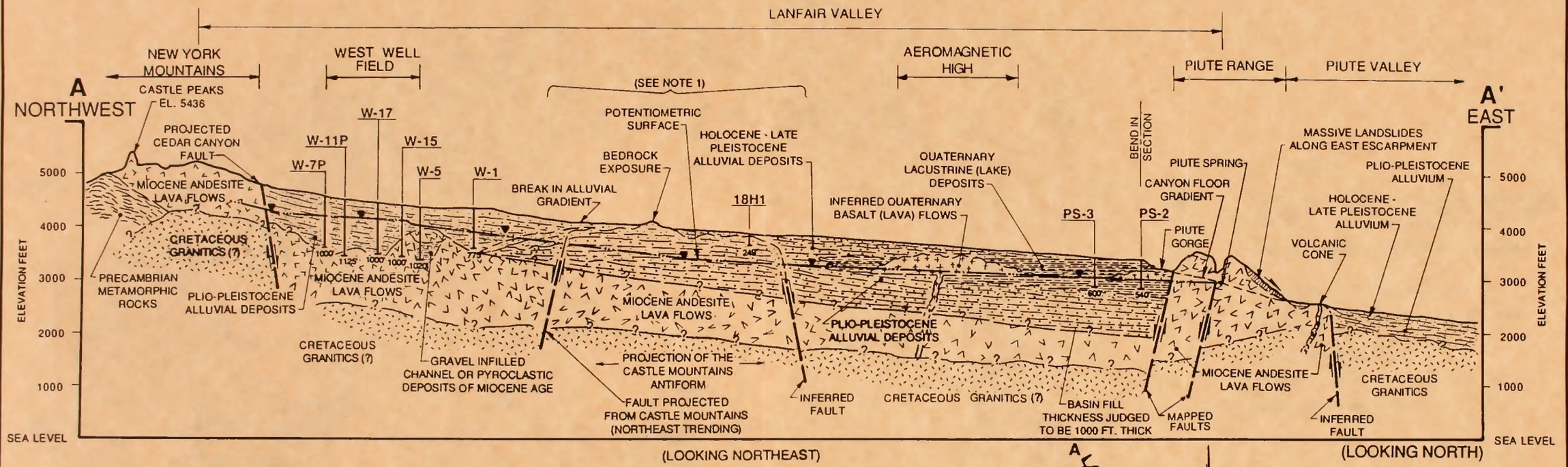
3. Figure 4.17 (Estimated Potentiometric Surface Map) illustrates the ground water elevation contours and ground water flow directions estimated from well and spring data, topographic and geologic conditions in Lanfair Valley, and survey data for Piute Spring. The potentiometric surface slope is highest near the mountains, becoming more gradual toward the southeast, coinciding with the general topographic expression. Also, the depth to water is shallowest in the western (recharge) portion of the basin, becoming deeper toward the east.

4. Ground water flow velocity through the unconsolidated deposits in the eastern portion of Lanfair Valley is estimated to be between 60 and 140 feet per year. These velocities indicate a ground water travel time of 600 to 1,400 years along the 16-mile distance between the West Well Field and Piute Spring. These flow velocities also indicate a total potential flow through the eastern portion of the valley of between 2,500 and 8,000 acre-feet per year.

4.5.2.2 Water Quality

1. Historical information from available references, and recent analyses of samples obtained from wells and Piute Spring, indicate that ground water in the area is of good quality, and meets the requirements for domestic water quality specified in California Title 22, Domestic Water Quality Regulations, 1977. A representative analyses of water quality in the West Well Field is shown in Table 4.3 (Ground Water Analyses, Well 18-P).

88-148B/RP REV. 4/24/90



SECTION A-A'

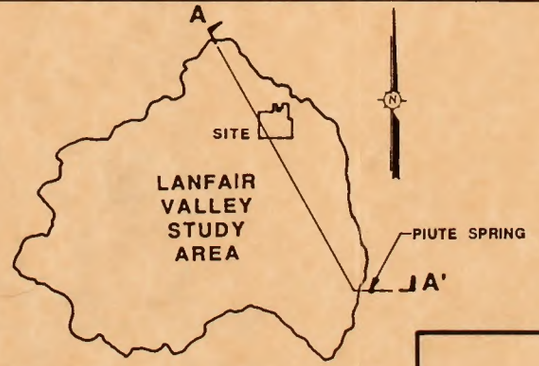
LEGEND

- POTENTIOMETRIC SURFACE
- INFERRED GEOLOGIC CONTACTS
- FAULT SHOWING RELATIVE MOVEMENT
- W-11P — WELL DESIGNATION AND WELL DEPTH
- 1000' — (NOTE: ALL WELLS LOCATED WITHIN 3000 FEET OF CROSS-SECTION WERE PROJECTED AND SHOWN ON THE SECTION.)

0 2 4 MILES

HORIZONTAL SCALE

APPROXIMATE VERTICAL EXAGGERATION: 5:1



CROSS-SECTION LOCATION

NOTE 1: THE POSSIBLE SHALLOW BEDROCK ZONE IN THIS AREA, WHICH WOULD TEND TO ISOLATE THE WEST WELL FIELD FROM THE PIUTE SPRING, IS INTENTIONALLY NOT SHOWN. THE ASSUMPTION OF CONTINUOUS ALLUVIUM THROUGHOUT THE VALLEY IS CONSERVATIVE FOR ESTIMATING POTENTIAL IMPACTS OF THE PUMPING.

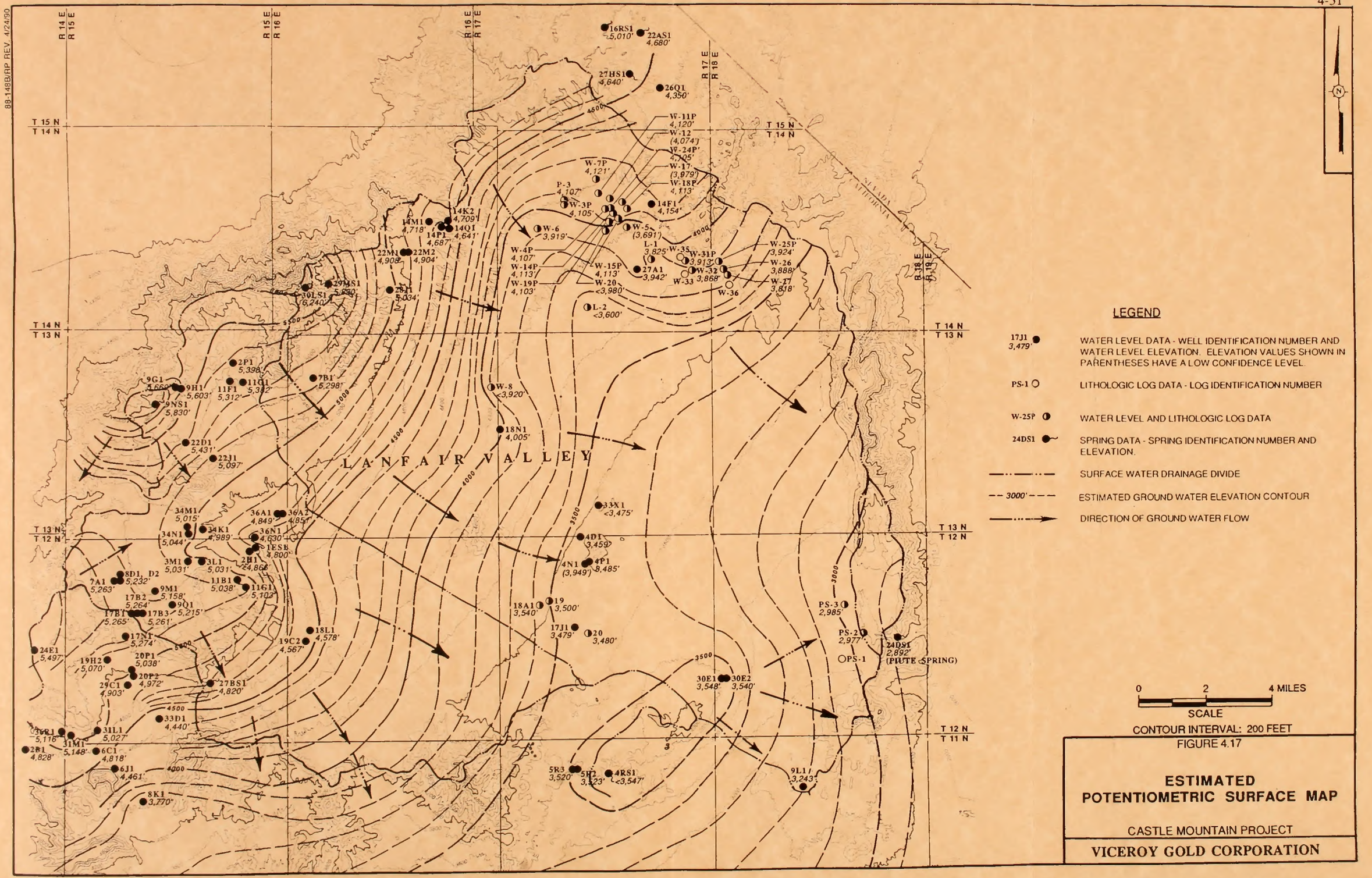
FIGURE 4.16

LANFAIR VALLEY HYDROGEOLOGIC CROSS SECTION

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LEGEND

- 17J1 ● 3,479' — WATER LEVEL DATA - WELL IDENTIFICATION NUMBER AND WATER LEVEL ELEVATION. ELEVATION VALUES SHOWN IN PARENTHESES HAVE A LOW CONFIDENCE LEVEL.
- PS-1 ○ — LITHOLOGIC LOG DATA - LOG IDENTIFICATION NUMBER
- W-25P ◑ — WATER LEVEL AND LITHOLOGIC LOG DATA
- 24DS1 ●~ — SPRING DATA - SPRING IDENTIFICATION NUMBER AND ELEVATION.
- —·—·— SURFACE WATER DRAINAGE DIVIDE
- – – 3000' – – ESTIMATED GROUND WATER ELEVATION CONTOUR
- —·→ DIRECTION OF GROUND WATER FLOW

0 2 4 MILES

SCALE

CONTOUR INTERVAL: 200 FEET

FIGURE 4.17

ESTIMATED POTENTIOMETRIC SURFACE MAP

CASTLE MOUNTAIN PROJECT

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TABLE 4.3

GROUND WATER ANALYSES, WELL 18-P

GENERAL CHEMISTRY RESULTS		UNITS
Carbonate	5.00	(mg/l)
Bicarbonate	153.00	(mg/l)
Hydroxide	5.00	(mg/l)
Total Alkalinity	153.00	(mg/l)
Chloride	33.20	(mg/l)
Color	1.00	-
Conductivity	440.00	(u ohms/cm)
Fluoride	0.70	(mg/l)
Surfactants	0.10	(mg/l)
Nitrate as Nitrogen	3.30	(mg/l)
Odor	1.00	(TON)
pH	7.80	-
Sulfate	25.20	(mg/l)
Total Dissolved Solids	304.00	(mg/l)
Turbidity	1.00	(NTU)

METAL RESULTS		UNITS
Silver	0.0500	(mg/l)
Arsenic	0.0070	(mg/l)
Barium	0.0300	(mg/l)
Beryllium	0.0100	(mg/l)
Calcium	33.40	(mg/l)
Cadmium	0.0004	(mg/l)
Cobalt	0.0200	(mg/l)
Chromium	0.0100	(mg/l)
Copper	0.02	(mg/l)
Iron	0.39	(mg/l)
Hardness	158.00	(mg/l)
Mercury	0.0005	(mg/l)
Potassium	4.50	(mg/l)
Magnesium	18.10	(mg/l)
Maganese	0.01	(mg/l)
Molybdenum	0.0200	(mg/l)
Sodium	39.10	(mg/l)
Nickel	0.0200	(mg/l)
Lead	0.0020	(mg/l)
Antimony	0.0020	(mg/l)
Selenium	0.0020	(mg/l)
Thallium	0.0020	(mg/l)
Vanadium	0.0500	(mg/l)
Zinc	0.02	(mg/l)

4.6 WILDLIFE

1. Information on wildlife is based upon previous research and field studies completed for the Draft EIS/EIR. From those studies a comprehensive species lists was prepared and is included as Appendix G, List of Wildlife.

2. The habitat of wildlife species can often be correlated to the plant communities in which they live. Eastern Mojave Desert habitats, especially creosote bush scrub and Joshua tree woodland, are widespread and therefore support a fauna that itself consists of mostly widely distributed species. Many of these species could therefore be found either as occasional or permanent onsite residents.

3. Lanfair Valley wildlife is typical of the eastern Mojave Desert, especially for species associated with the predominant creosote bush scrub and Joshua tree woodland habitats. Wildlife consists primarily of widely distributed species including reptiles, various resident and migratory birds, a range of desert mammals, and an amphibian.

4. The single amphibian species known in the region is the red-spotted toad (*Bufo punctatus*). This toad is known to occur at Piute Spring and other desert springs and ephemeral water sources in desert canyons. It is also expected to occur in the New York Mountains, where reliable water sources can be found.

5. The reptile species which may be found in the region are typical of similar locations in the eastern Mojave Desert. Most are widely distributed species of lizards and snakes. The desert tortoise (*Gopherus agassizii)* population is low at the elevation of the northern portion of Lanfair Valley, but large populations are well documented in the lower elevation Ivanpah and Piute Valleys. Gould (1987a) found a desert tortoise shell on the project site, and subsequent onsite studies have found five or six possible tortoise burrows, although no tortoises or sign were found when the burrows were inspected during the hibernation period (BLM, 1990).

6. Most mammals observed or expected to occur in Lanfair Valley are common and wide-spread species typical of high desert areas. Common species include the coyote *(Canis latrans)*, black-tailed hare *(Lepus californicus)*, desert cottontail *(Sylvilagus auduboni)*, and the antelope ground squirrel *(Ammospermophilus leucurus)*. Desert woodrat *(Neotoma lepida)* nests have been observed on the project site by Gould. Several species of mice *(Peromyscus* spp.*)* and other common small mammals also are expected to be present. Populations of desert bighorn sheep *(Ovis canadensis)* live in the surrounding mountains.

7. Bats are expected to occur among the rocks and Joshua trees of Lanfair Valley, which are expected to provide sites for daytime roosts, maternity roosts, and winter hibernation. Abandoned mine workings of the Hart Mining District also provide some habitat.

8. Most of the birds known or expected to occur in the Lanfair Valley are widely distributed desert species. Many are not permanent residents, but simply fly over, forage, or feed in the area for a short time, often seasonally. Several raptors (falcons, eagles, vultures, hawks, and owls), all widely distributed species, are known or expected to occur within the region. Various species are known to feed in the Lanfair Valley area. An immature golden eagle *(Aquila chrysaetos)* was observed in Lanfair Valley about three miles south of the proposed project site (Gould, 1987b). This species probably nests at higher elevations and cliffs in the New York Mountains and elsewhere in the region and forages widely throughout the desert. Although not listed as threatened or endangered, the golden eagle is a fully protected species in California DFG Code, Section 3511) and receives additional Federal protection under amendments to the Bald Eagle Protection Act (16 U.S.C. § 668 *et seq.*). Raptors and many other birds are protected under the Federal Migratory Bird Treaty Act.

9. In addition to typical desert bird species, open pools of water, when they occur in the region, are known to attract migrating shore, aquatic, and water birds. Because of the general absence of water, their numbers are expected to be limited, but some of these species may occasionally visit areas of Lanfair Valley where there is standing water, such as at livestock watering facilities.

10. A Biological Assessment (Environmental Solutions, Inc., 1990c) discussing the potential impacts of the project upon the desert tortoise was prepared for formal consultation with the FWS in accordance with the Endangered Species Act. A finding of "No Jeopardy" was issued by the FWS in August, 1990, as part of its Biological Opinion for the Castle Mountain Project.

4.7 AIR RESOURCES

4.7.1 CLIMATE

1. The Castle Mountain Project site is located in the eastern San Bernardino County portion of the Southeast Desert Air Basin. The climate of the basin is generally hot and dry in the summer and mild in the winter, with limited precipitation and cloudiness. Precipitation in Lanfair Valley averages about eight inches per year, occurring primarily during winter months. However, a significant portion of the annual rainfall can occur as summer thunderstorms, which can result in heavy rainfall and flash floods. Wind speeds are usually high enough to promote good mixing, averaging between 5 and 13 miles per hour. Summer and winter winds are similar, generally blowing from the south and west.

2. Air quality permits will be required by the San Bernardino County Air Pollution Control District (SBCAPCD) for various project facilities and operations. Applications have been made to the SBCAPCD for an Authority to Construct and Permit to Operate.

4.7.2 AIR QUALITY

1. Information provided by officials at the SBCAPCD indicates that the project vicinity has been in attainment of National and State ambient air quality standards. Based on monitoring data and the absence of major pollution sources, the overall air quality in the vicinity of the project site is expected to be good.

2. Air quality permits will be required by the SBCAPCD for various project facilities and operations. Applications have been made to the SBCAPCD for an Authority to Construct and Permit to Operate.

4.8 CULTURAL RESOURCES

1. Cultural resource investigations conducted for the project included inventories for access roads, general reconnaissance of the project area, and specific inventories of:
   - Primary mine and heap leach recovery area (project site).
   - Southeast of the open pit mine and overburden area (offsite).
   - North of the open pit mine area (offsite).
   - Water well drill sites northwest of the project site (West Well Field).
   - Mitigated Access Route.
   - Monitoring well drill sites.

2. The results of these investigations were submitted to the State Historic Preservation Officers (SHPOs) of California and Nevada and to the Advisory Council on Historic Preservation (ACHP). Each site was evaluated for National Register of Historic Places (NRHP) eligibility and the potential effect of project activities and mitigation measures as required. Determinations are included in Appendix H, Cultural Resource Consultation. ACHP has concurred in the BLM/SHPO determinations.

APPENDIX A

RECLAMATION MITIGATION MEASURES

APPENDIX A

RECLAMATION MITIGATION MEASURES

POTENTIAL EFFECTS	MITIGATION MEASURES	TEXT REFERENCE IN THE MINE PLAN AND RECLAMATION PLAN
GEOLOGY		
1. Potential ground motion from earthquakes could pose a hazard to project facilities.	1.1 Artificial slopes shall be constructed at the natural angle of repose (other than pit walls) and benched as necessary to prevent soil movement.	S-2 S-9 Section 1.10.1
2. Loss of potentially economic ore.	2.1 Protore shall be separated in overburden pile to the extent practical.	Section 2.1
VEGETATION		
1. Onsite and offsite facilities and operations activities would disturb about 915 acres of vegetation in the Joshua tree woodland, blackbush scrub, and creosote bush communities. About 200 acres of desert grassland Unusual Plant Assemblage would be removed.	1.1 In order to maximize the success and reduce the time of revegetation, the Applicant shall develop a revegetation research program based upon information provided by qualified experts in desert flora. This research program shall include measures such as:	S-8 Section 1.1.3.2, 1.4
	• Review of available materials describing methods and success rates of revegetation programs employed on other lands in the arid west to determine the best available procedures.	Section 1.4
	• Development of the methodology for research and a schedule for implementation of the revegetation program for submittal to BLM and the County within the first year of project operation.	Section 1.4, 1.6
	• Revegetation success shall be determined by measuring the density and diversity of perennial species. The 10-year goal for density, using only perennial species, will be 21 percent as compared to relatively undisturbed control sites. Using a sigmoidal curve, the 5-year goal for density will be six percent of the control. The 10-year goal for diversity will be 15 percent, expressed us a similarity index of the control. The 5-year goal for diversity, based on a sigmoidal curve, will be four percent, expressed as a similarity index of the control. The diversity and density measurements will be based on randomly allocated plots located within areas representative of the reclaimed lands.	Section 1.3
	• Stockpiling of available soil. Redistribution of soils over disturbed areas shall be done following completion of activities on an area. Studies shall be completed to determine where available soil would be most effectively used.	Section 1.5.4
	• Identification of dominant species to be used in revegetation. Salvaging of individuals of species amenable to transplantation, such as Joshua trees and barrel cactus, shall be completed and such plants would be kept in nursery areas for replanting on reclaimed areas to provide a continuous seed source. A goal would be	Section 1.5.3, #2

Source: Castle Mountain Project Final EIS/EIR Table S.1, Summary of Potential Effects and Mitigation Measures.

APPENDIX A

RECLAMATION MITIGATION MEASURES

POTENTIAL EFFECTS	MITIGATION MEASURES	TEXT REFERENCE IN THE MINE PLAN AND RECLAMATION PLAN
VEGETATION - Continued	to transplant at least 25 percent of barrel cactus and 25 percent of all Joshua trees three to ten feet in height, unbranched or with few branches.	
	• Selection of a site appropriate for a nursery. Considerations would include water availability, access, and other requirements determined by the revegetation experts.	Section 1.5.2
	• A plan shall be developed to coordinate and phase revegetation efforts in accordance with mining and processing operations. A goal would be to initiate revegetation procedures within six months following completion of project activities over an area.	Section 1.6
	• Employment of reseeding, transplantation, fertilization, and watering procedures determined appropriate for each disturbed area in the program methodology.	Section 1.5.7, 1.5.11, 1.5.13, 1.5.14
	• Evaluation of the benefits of removing, shredding, and composting vegetation that would otherwise be lost.	Section 1.5.15
	• Ground preparation procedures shall include ripping and harrowing of compacted soils. Criteria for slope gradients shall be determined through onsite research on revegetation success.	Section 1.5.4, 1.5.5
	• Implementation of a 5-year monitoring program following project completion to verify revegetation results based upon the goals for species diversity and density.	Section 1.3.2
	1.2 Revegetation efforts shall be initiated as soon as possible during the project operation period, as use of specific disturbed areas is completed.	
	1.3 The project revegetation program shall collect data on revegetation and recovery of the desert grassland and provide such data to BLM to supplement UPA monitoring and planning strategies.	Section 1.4.1
	1.4 Vegetation considered unnecessary for reclamation shall be made available for public collection through plant salvages conducted by BLM.	Section 1.5.3
	1.5 Vegetation within areas of temporary disturbance (such as for well construction) shall be crushed instead of bulldozed to enhance recovery.	Section 1.6.1, #3
	1.6 Road Segment A of the Mitigated Access Route shall, to the extent possible, use the existing alignment of the YKL Ranch water pipeline maintenance road for access to State Route 164.	Section 2.4.3.1, #5
	1.7 Baseline vegetation measurements shall be completed as part of the revegetation research program prior to surface-disturbing activities.	Section 1.4.1

Source: Castle Mountain Project Final EIS/EIR Table S.1, Summary of Potential Effects and Mitigation Measures.

RECLAMATION MITIGATION MEASURES

POTENTIAL EFFECTS	MITIGATION MEASURES	TEXT REFERENCE IN THE MINE PLAN AND RECLAMATION PLAN
VEGETATION - Continued		
	1.8 Fencing shall be used to exclude livestock from revegetation areas until termination of the project and maturation of the revegetated areas, such that grazing can be accommodated. The Applicant shall be responsible for removing fences enclosing these areas at an appropriate time, as determined by the BLM.	Section 1.5.7, #5 Section 1.7.1
	1.9 Subject to BLM approval of reclamation procedures and completion of public road right-of-way abandonment proceedings by Clark County, Nevada, the Applicant shall reclaim County Road A68p for use as an equestrian trail. The Applicant shall provide barriers to vehicular traffic on County Road A68p to render it impassible.	Section 1.6.1, #3
	1.10 Clay pits shall be reclaimed using overburden, with rock staining of the upper pit wall of the clay pit on the Big Chief Hill.	Section 1.6
	1.11 The Applicant shall comply with all the reclamation requirement set forth in the Mine/ Reclamation Plan including, but not limited to, instituting the required revegetation program.	Section 1.3, 1.4, 1.5, 1.6, 1.7, and 1.8
2. Surface disturbance could provide opportunities for establishment of exotic plant species.	2.1 Revegetation efforts shall be initiated as use of acres is completed. Weed control shall be implemented in conjunction with fertilization and seeding. If invasion of exotic species becomes a problem, a program for weed control shall be implemented in compliance with applicable State and Federal laws.	Section 1.4, 1.5.8, 1.5.12, and 1.5.15
3. Project ground water withdrawal could affect stream flow and riparian vegetation at Piute Spring.	3.1 Detailed hydrologic studies and modeling were completed for this document to determine potential impact. Results demonstrated no significant reduction in flow would occur. No significant impact to vegetation is, therefore, expected.	Section 4.5.2
4. Surface disturbances could impact plant species recognized by various agencies or groups as rare, threatened. endangered, or sensitive.	4.1 Onsite inventories and literature reviews were completed for this document to determine potential occurrence. No plants afforded legal protection or of special concern are known or expected to occur on the site.	Section 1.9.2.3
	4.2 The onsite location of the *Penstemon stephensii* (a Category 2 species) population is outside the area of project facilities and would therefore not be disturbed by project operations. However, the population could be eliminated during required reclamation of mine exploration drill roads. The following measures are therefore recommended:	Section 1.5.9.2, 1.9.2.3
	• Flag, fence, sign, and/or otherwise delineate the onsite population to ensure avoidance during project construction and operations. Protect other discovered populations in a similar manner, as appropriate.	Section 1.4.1, #6

Source: Castle Mountain Project Final EIS/EIR Table S.1, Summary of Potential Effects and Mitigation Measures.

APPENDIX A

RECLAMATION MITIGATION MEASURES

POTENTIAL EFFECTS	MITIGATION MEASURES	TEXT REFERENCE IN THE MINE PLAN AND RECLAMATION PLAN
VEGETATION - Continued		
	• Monitor the known population and other individuals/populations that could occur during project operations.	Section 1.4.1, #6
	• If individuals do not appear elsewhere onsite, collect and broadcast seed from the known population to other onsite areas or transplant individuals to other locations prior to reclamation of mine exploration drill roads.	Table 1.2 Section 1.5.8
WILDLIFE		
1. Vegetation removal would degrade habitat for wildlife. Site and access roads are included in habitat range of some special interest species, including Bendire's thrasher, desert bighorn sheep, desert tortoise, and various raptors.	1.1 Habitat quality shall be reestablished through revegetation by the reclamation program.	Section 1.2.2 Section 1.1.4
AIR QUALITY		
1. Fugitive dust from activities could increase PM particulate levels. Total PM_{10} from project activities is estimated to be about 64 tons per year.	1.2 Revegetation efforts shall be initiated as use of certain areas is completed. This would reduce potential for fugitive dust.	Section 1.6
HEALTH AND SAFETY		
1. Potential accidents associated with entry into the reclaimed mine site.	1.1 A comprehensive reclamation plan that includes public safety measures shall be implemented.	Section 1.1.4, 1.2.2, and 1.10.2
VISUAL RESOURCES		
1. Operation activities, equipment, and structures would change visual character of site from passive to active.	1.1 All operating facilities, including structures, equipment, transmission lines, and fencing, shall be removed at project completion, as required by BLM and by the reclamation plan.	Section 1.8, 2.4.2.2
2. Project would modify topography and visual appearance of site. Upper walls of mine pits, overburden, heap piles, and existing clay pits would be visible from locations in Lanfair Valley.	2.1 Overburden and heap leach piles shall be constructed in locations that minimize the degree to which they would be seen from primary roads. Low hills would partially conceal overburden. Heap piles would form low mesas near the valley floor. Overburden shall be placed over clay pits.	Section 2.4.3, 4.3
	2.2 Site reclamation shall include modification of overburden and heap pile shapes to reduce potential impact of straight line geometrics. Revegetation shall be undertaken to assist in reducing color contrasts. Upper mine pit walls shall be stained to reduce color contrasts. Clay pits shall be reclaimed and upper wall of the clay pit on Big Chief Hill stained.	Section 1.6, 2.4.3, and 4.3.4.1

Source: Castle Mountain Project Final EIS/EIR Table S.1, Summary of Potential Effects and Mitigation Measures.

RECLAMATION MITIGATION MEASURES

POTENTIAL EFFECTS	MITIGATION MEASURES	TEXT REFERENCE IN THE MINE PLAN AND RECLAMATION PLAN
VISUAL RESOURCES - Continued		
	2.3 Revegetation shall include some areas within the project boundary and along access roads that were disturbed by the actions of third parties prior to the time that reclamation of such disturbances was required under FLPMA and SMARA. Clay pits shall be reclaimed using overburden, and rock staining on the upper pit wall of the clay pit on Big Chief Hill. In addition, subject to BLM approval of reclamation procedures and completion of public road abandonment procedures to be implemented by Clark County, Nevada, the Applicant shall reclaim County Road A68p for use as an equestrian trail. The Applicant shall berm and fence both terminus points of County Road A68p to deter vehicular access.	Section 1.6, 2.4.3, and 4.3.4.1
LAND USE		
1. Project activities could be incompatible with other uses of site and surrounding area including clay pit mining activities, livestock grazing, and recreation uses.	1.1 Applicant shall construct and maintain fencing to restrict livestock from operational areas. Cattle guards shall be installed points where fences cross access roads.	Section 1.7.1
	1.2 Applicant shall provide alternate water sources if project activities would interfere with existing livestock watering facilities.	Section 1.2.2.
	1.3 Reclamation plans and procedures shall include provisions to continue existing uses following project completion. Mine pits shall be accessible to operators for additional recovery of low grade ore. Revegetation of grassland would provide for livestock grazing. Casual recreation activities would again be permitted in the project area.	S-1 S-3 Section 1.2
2. Provision of improved access from Piute Valley could increase recreational uses in Lanfair Valley with indirect impacts to wildlife and grazing uses.	2.1 Access route use shall be limited to operational period. Public use would discontinue following road reclamation.	S-6 Section 1.8.7

Source: Castle Mountain Project Final EIS/EIR Table S.1, Summary of Potential Effects and Mitigation Measures.

APPENDIX B

BLM/STATE OF CALIFORNIA
MEMORANDUM OF UNDERSTANDING

MEMORANDUM OF UNDERSTANDING

Surface Mining and Reclamation Coordination in the State of California in accordance with California's Surface Mining and Reclamation Act (SMARA) of 1975, as amended,

by and between the

STATE OF CALIFORNIA, DEPARTMENT OF CONSERVATION AND THE STATE MINING AND GEOLOGY BOARD

and

the

U. S. DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT, CALIFORNIA

THIS AGREEMENT is made and entered into by and between the State of California, Department of Conservation, through its Director, and the State Mining and Geology Board, through its Chairman (jointly referred to herein as "the State"), and the Bureau of Land Management (BLM), through its State Director, California, for the purposes of: (1) assuring the consistent application of adequate and appropriate reclamation throughout the State of California; (2) simplifying the administration of surface mining and reclamation practice requirements on Federal lands and on a combination of Federal and private lands; (3) achieving coordination of activity governing reclamation; and (4) eliminating duplication among the aforementioned agencies and counties serving as lead agencies ("lead agencies" pursuant to the Surface Mining and Reclamation Act, Public Resources Code Section 2728) in implementing State and Federal requirements.

WITNESSETH:

WHEREAS, local, State, and BLM have certain legal requirements in regulating the effects of surface mining on Federal lands and on combinations of Federal and private lands, it is deemed advisable to develop an understanding between BLM and the State to serve as guidance for

local agencies, BLM and the State in fulfilling their agency regulatory responsibilities in such situations.

WHEREAS, for purposes of this agreement, the following are exempt from SMARA pursuant to Public Resources Code Section 2714:

(1) Prospecting for, or the extraction of, minerals for commercial purposes and the removal of overburden in total amounts of less than 1,000 cubic yards in any one location of one acre or less;

(2) Surface mining operations that are required by federal law in order to protect a mining claim (i.e. annual assessment work), if such operations are conducted solely for that purpose; and

(3) Such other surface mining operations which the State determines to be of an infrequent nature and which involve only minor surface disturbances.

WHEREAS, a Memorandum of Understanding (MOU) between the State, and BLM, governing surface mining and reclamation coordination in the State of California, was signed in 1979 and remains in effect until this new agreement is signed by each party.

WHEREAS, several acts of Congress provide for persons to prospect and mine on Federal lands which are administered by the BLM, and which are open to the operation of the United States mining, mineral leasing and mineral materials laws, providing they comply with the rules and regulations covering the Federal lands involved (applicable regulations include 25 CFR 211, 43 CFR 3802, 3809, 3500, and 3600).

WHEREAS, Federal laws and regulations require that operations authorized under Federal mining, mineral leasing, and mineral material laws shall be conducted so as to minimize adverse environmental impact, or prevent unnecessary or undue degradation caused by such operations, and that the land be reclaimed to a second productive use, where practicable.

WHEREAS, BLM is authorized to work with the State for the purposes of coordinating Federal, State and local regulatory activities for environmental protection [applicable regulations include 43 CFR 3809.3-1(a)-(c)].

WHEREAS, for proposed mineral operations, the purpose of both the National Environmental Protection Act of 1969 (NEPA) and the California Environmental Quality Act (CEQA) is to assure the identification, analysis, and disclosure of significant environmental impacts associated with proposed projects and

the incorporation of feasible mitigation to address significant adverse environmental impacts.

WHEREAS, the statutory requirements of the National Environmental Protection Act of 1969 (NEPA) for the BLM and the California Environmental Quality Act (CEQA) for State and local agencies are largely equivalent.

WHEREAS, city and county "lead agencies" have the responsibility under the Surface Mining and Reclamation Act of 1975 (Public Resources Code Sections 2710-2795), as amended, and State policy for surface mining and reclamation practice (California Code of Regulations Sections 3500-3505), to regulate surface mining and reclamation within their jurisdictions to assure that:

(1) Adverse environmental effects are prevented or minimized and that mined lands are reclaimed to a usable condition which is readily adaptable for alternative land uses;

(2) The production and conservation of minerals are encouraged, while giving consideration to values relating to recreation, watershed, wildlife, range and forage, and aesthetic enjoyment; and

(3) Residual hazards to the public health and safety are eliminated.

WHEREAS, "lead agencies" are cities, counties, or other agencies designated by the Board which have the principal responsibility for approving a surface mining operation or reclamation plan (as defined by SMARA and other relevant regulations and ordinances) pursuant to the provisions of SMARA, and the use herein of the words "lead agencies" shall signify the Board's approval for lead agencies to use the guidance in this MOU to satisfy the requirements of applicable State laws and regulations for surface mining and reclamation on lands in California.

WHEREAS, lead agency surface mining and reclamation ordinances certified by the Board include and comply with applicable provisions of State laws and regulations for surface mining and reclamation practice.

NOW, THEREFORE BE IT RESOLVED that the parties to this memorandum hereby understand and agree that the following will satisfy the aforesaid requirements of the aforesaid laws and are acceptable to both BLM and the State. It is agreed that in regulation of surface mining of minerals on Federal lands and on combinations of Federal and private lands that:

(1) Lead agencies and BLM will work cooperatively to insure that conditions required of operators (as defined by Federal law, and by SMARA and any other relevant regulations and ordinances) in minimizing adverse environmental impacts conform to all applicable local, State, and Federal regulations.

(2) Lead agencies may accept as functionally equivalent documents to meet their requirements under SMARA, operating plans, reclamation plans and environmental studies submitted pursuant to federal regulation provided such plans and studies meet or exceed lead agency requirements as included in the lead agency's State-certified surface mining and reclamation ordinance and any other applicable laws and regulations; and alternatively, BLM may accept as functionally equivalent documents to meet their requirements, operating plans, reclamation plans and environmental studies submitted to the lead agency when such plans and studies meet or exceed requirements set by the BLM.

(3) Lead agencies may accept as functionally equivalent, documents prepared under NEPA (40 CFR 1500-1508) that meet the requirements of CEQA.

(4) Lead agencies and BLM will use, insofar as applicable, guidelines and a checklist (upon approval by the parties to this agreement) in the development of appropriate environmental documents and reclamation plans.

(5) Lead agencies may enter, and in fact are encouraged to enter, into specific area agreements (including, but not limited to, joint powers agreements and MOUs) with BLM for purposes of implementing this agreement, coordinating reviews, avoiding duplication, and facilitating participation by affected agencies. Issues that may be addressed by such agreements include, but are not limited to, the filing, review, and procedures for approval of reclamation plans, fees, public inspection and enforcement activities, and bonding requirements. Such specific area agreements shall be in conformance with the lead agency's certified surface mining and reclamation ordinance and Federal law and regulation. A model is being prepared to be used as guidance for the development of such agreements upon its approval by the parties to this agreement.

(6) By written agreement BLM may delegate authority to lead agencies to be solely responsible for processing, to approval, all mining operations which are subject to federal mining law in accordance with 43 CFR 3809. A delegation agreement may provide, among other things, for lead agencies to forward copies of submitted exploration and development permit applications to BLM; to provide a 10-day comment period to BLM; and prior to approval, or rejection, to provide BLM 5 working days to comment on proposed reclamation and other requirements.

(7) For the purposes of this agreement, assessment work required to protect claims under federal law is defined as prospecting or exploration work completed for the purposes of discovering an ore body. It does not include development drilling or extraction of minerals for commercial purposes, which are not exempted from the provisions of SMARA.

(8) For BLM's Notices (written notification required to be provided to the BLM under 43 CFR 3809.1-3) for those operations of 5 acres in size or less, within 5 days after receipt by BLM of an accepted Notice, BLM will forward a copy of the Notice to the lead agency for appropriate action by the lead agency. The lead agency may correspond directly with the operator for purposes of approval in accordance with SMARA, including any and all additional conditions and requirements, and will send copies of all correspondence and requirements to the BLM.

(9) For any mining operations requiring a Plan of Operations for projects solely on Federal land, BLM will provide lead agencies notice and the opportunity for early participation, consultation, and submission of information and recommendations for the development of Environmental Assessment Reports and reclamation plans.

(10) Within 30 days of receipt of notification under paragraph (9) above and copies of relevant informational documents, lead agencies will provide comments and recommendations to BLM so that they may be considered and incorporated, as appropriate, as part of the environmental review and proposed BLM decision.

(11) BLM will forward the environmental and decision documentation, which includes the reclamation plan requirements, to the lead agency for appropriate consideration. Public hearings for compliance with

SMARA and the certified lead agency SMARA ordinance should be coordinated with BLM. The lead agency will correspond directly with the applicant, and send copies to BLM, regarding adopted conditions of approval which differ from conditions of BLM approval.

(12) Lead agencies will forward to BLM copies of all surface mining proposals and draft reclamation plans they receive for operations located entirely on BLM lands.

(13) Implementation of measures to mitigate adverse environmental impacts to off-site, non-federal lands will be authorized, permitted, or otherwise directed by the lead agency or other responsible local or State agency.

(14) Lead agencies will notify the BLM whenever an application for approval of mining activities is received and a draft reclamation plan is completed for an operation which comes under the purview of SMARA and lead agency requirements on areas adjacent to BLM public lands, and will give the BLM an opportunity to provide information and recommendations for such plans.

(15) Lead agencies and BLM will review and coordinate Environmental Documents, Operating Plans, Reclamation Plans and Permits for those mining operations that include both BLM lands and private lands. The objective of the review and coordination process is to avoid conflicting and duplicative requirements in Operating Plans and Permits and to keep procedural impacts on the mining operators to a minimum necessary to meet all applicable requirements. Coordination responsibilities for operations encompassing two or more mixed private and BLM ownerships should be determined on a case-by-case basis by the parties involved.

(16) BLM will approve the Plan of Operations when the operator agrees to the conditions and stipulations, including the appropriate measures to mitigate adverse environmental impacts, incorporated into the plan or permit to meet applicable BLM, State and local reclamation requirements. The operator must also comply with other applicable Federal, State, and local laws and regulations including those pertaining to hazardous substances.

(17) Where BLM is the operator (i.e., for community pits), and where a Federal agency contractor will be the operator for surface mining activities on Federal lands, requirements for reclamation and any other necessary environmental documentation will be prepared and approved in accordance with the consultation procedures of this MOU to assure that private activities on BLM lands meet all applicable local, State, and Federal requirements.

(18) To the extent practicable, lead agencies and BLM will coordinate their enforcement and monitoring responsibilities, and will cooperate in the correction and abatement of any violations of the conditions of operation imposed in accordance with the procedures described in this MOU.

(19) BLM, in consultation with lead agencies, will be responsible for determining whether a reclamation bond or other assurance is needed on Federal land, and if so, the amount and adequacy of the bond or other assurance, making adjustments, and releasing the bond after completion of reclamation. Any federally-required bond or assurance may be used to satisfy local and State surety requirements.

Effective Date of this Agreement:

This agreement shall become effective upon each party by signature of that designated party and shall supersede the previously referenced 1979 MOU when signed by all parties.

Modification of this Agreement:

This agreement may be modified upon the initiative of any of the parties for the purpose of ensuring consistency with state or federal statutes or regulations, or for any other purpose mutually agreed upon. In order to be effective, any such modification must be in writing, subject to 30 days notice, and must be signed by all of the designated parties.

Termination of this Agreement:

This agreement shall continue in force until terminated by any party upon thirty (30) days written notice to the other parties. The parties intend to review this agreement at the end of 12 months, and periodically thereafter, as needed.

STATE OF CALIFORNIA:

Randall M. Ward
Director,
Department of Conservation

DATE: 1-19-90

BUREAU OF LAND MANAGEMENT:

Ed Hastey
State Director

DATE: 2/7/90

STATE OF CALIFORNIA:

James A. Aris
Chairman,
State Mining and Geology Board

DATE: 1·25·90

APPENDIX C

GUIDELINES FOR THE DEVELOPMENT OF A REVEGETATION PLAN

Guidelines for the Development of a Revegetation Plan

OVERVIEW

Reclamation will be a continuous process during the operation of the Castle Mountain Project by Viceroy Gold as specific sites such as individual pits and leach pads are phased out of operation. The revegetation research will also be a continuous program to allow an assessment of specific revegetation practices for the site and to help solve unanticipated problems that may arise during the revegetation efforts. The research plan outlined here provides an overview of the key problems associated with successful plant establishment on the site and the general approaches to be followed. A successful research program will require close coordination between the researchers and the Environmental Affairs Office of Viceroy Gold Corporation.

The general problems of reclamation for arid sites have been described in some detail throughout this document. Revegetation strategies for California Deserts have received relatively little attention (Virginia and Bainbridge 1986, Bainbridge and Virginia 1990). Low and unpredictable rainfall, soil problems including low soil fertility and disruption of soil structure, and biological problems (e.g., herbivory) will be challenges for the revegetation program. Many practical concerns facing the Castle Mountain Project such as obtaining the necessary materials for plant propagation and establishment (viable locally collected seed, developing vigorous container grown shrubs for transplant, properly collected and maintained wildings) and selecting the best species to match site conditions will require information developed from the research program.

The general criteria for revegetation for the Castle Mountain Project are provided in detail in section 4.6.3. Key information is identified as lacking concerning irrigation and fertilization, mulching, and species selection for various areas. This comprehensive revegetation plan treats the soil and plant problems that will occur in the reestablishment of a

diversified, self-perpetuating plant community similar in structure and composition to that existing prior to the mining. However, this plan is based on the limited available information for revegetation in the Mojave Desert. The objective of the research program will be to conduct experiments and demonstrations that focus on defined revegetation problems facing Viceroy Gold at Granite Mountain. These experiments will be designed to permit statistical analyses so that an unbiased evaluation of treatments can be made.

REVEGETATION RESEARCH

Revegetation at the Castle Mountain Site will use three strategies for the reestablishment of herbaceous and woody plants. These approaches are direct seeding, transplanting of container grown stock, and transplanting of wildings collected prior to site disturbance. The major research questions and management concerns that should be addressed for each strategy are identified below as well as the general research methodology that will be employed to provide decision making information and to assess the success of these strategies.

Plant Establishment: Direct Seeding

The unpredictable rainfall in the Mojave Desert makes direct seeding difficult without support. However, the relatively low cost of direct seeding compared with planting established stock, and the chance that it may be successful in a year with favorable rainfall, or with supplemental water make this option viable. Direct seeding, when successful, is one of the better methods of establishment. Roots are undisturbed and growth can surpass transplanted plants.

Research Objectives

Evaluate seed sources (local collection, assessment of soil seed bank) for revegetation by plant community type.

Determine timing of seed collection by species for maximum yield and viability

Recommend seed cleaning and storage protocols

Compile information on species specific germination requirements and perform germination tests when indicated

Develop information on seed bed preparation (fertilization, soil tillage and contouring, mulching) practices associated with acceptable seed germination and seedling establishment.

Evaluate the effectiveness of proposed seed distribution and planting methods

Examine practices for seed and seedling protection from herbivory

Design a monitoring program to evaluate the success (density, species composition) of the experimental direct seeding efforts.

Seed availability: Local seed sources are desirable since ecotypic variation (local genetic variability) may be high. A seed collection plan for the site should be developed after review of the literature for data on the timing of seed development and maturity for the key species listed in the revegetation plan. A survey of commercial suppliers and their ability to provide or collect seed should be made to determine the most economical route for obtaining seed on a schedule compatible with the field planting schedule. If Viceroy collects seed, then seed cleaning and storage protocols should be developed from literature research of this topic. For each species planted, a profile should be developed summarizing information on the life history of the plant, timing of seed production, special germination requirements such as scarification of the seed coat, and information (if any) on optimal soil conditions for germination.

Seed Quality and Germination: Trials will be established to determine the germination percentage of collected and/or purchased seed. From each of the plant growth forms (grasses, forbs, shrubs) used for the direct seeding program, two or more species (see table 4-3 for species list) will be tested. This information is needed to apply the appropriate amount of seed

per unit area to achieve acceptable plant cover under good germination conditions. Seeds will be germinated in material resembling the texture and fertility of the growth media that will be redistributed across the site after mining. These trials will be conducted in a plant growth structure (e.g., lathe house, approximate size 30 x 60 ft) under environmental conditions judged favorable for seed germination. The effects of nutrient additions (inorganic fertilizers) on germination will also be examined by adding the fertilizer types to be tested for field scale amendments. These fertilizer sources will include fast and slow release complete fertilizers (N,P,K). Micronutrient fertilizer additions will be tested if germination rates are low.

Field Seeding Strategies: Based on results from the above small-scale experiments, field trials will be conducted to evaluate seedling germination under a variety of conditions. Small replicated plots will be established. Experiments will be designed to examine: fertilizer effects on germination and early growth, influence of incorporation of mycorrhizal fungal inocula into the soil on seedling growth, mulching strategies as an aid to germination, the efficacy of supplemental water versus natural precipitation for germination, and methods for protection of emerging seedlings from herbivory. The types of measurements to be taken will be: number of emerging seedlings at regular time intervals; survival of seedlings marked after germination; and, root development assessed by destructive harvest of a subsample of key species.

Plant Establishment: Transplants

Desert plants can be established by transplanting nursery grown stock or wildings collected from other sites ahead of grading or disturbance. Transplanting can give quick establishment and early improvement of aesthetics. Transplants also improve the soil environment (e.g., microclimate) and may facilitate revegetation by other plants even if the transplant fails. The use of this strategy requires research at two levels. First, information about plant propagation for key revegetation species (such as creosote bush, blackbrush, mormon tea) must be developed, and second, field planting techniques and soil management must be addressed.

Research Objectives

Develop efficient plant growing systems for dominant species and sensitive species of critical concern as determined by the plant survey. Factors to be considered are: container size and shape for optimum root/shoot ratio; growth media for proper soil moisture and nutrient retention; fertility management including fertilizer type, amount, and timing of applications; inoculation with mycorrhizal fungi; and water delivery systems for proper moisture management.

Determine for key revegetation species the time required for growth from seed to a plant of suitable size for transplanting in the field.

Determine the methods to be used for the collection, propagation, and transplanting of wildings. To be considered are size of wilding and transplant success, container management if wildings are to be held in the nursery.

Examine and make recommendations on soil preparation requirements for successful transplanting including: fertilization requirements; soil tillage and contouring strategies to increase soil moisture; mulching requirements; irrigation needs and delivery systems; and plant protection from herbivory.

Evaluate transplanting techniques including protocols for plant hardening prior to transplant

Evaluate transplant success based on survival, plant growth rate, time to seed production.

Nursery Plants: Nursery cultivation of desert plants is possible, although more costly than direct seeding. Critical concerns are the selection of container types for good root system development, potting media with good soil moisture and nutrient retention characteristics, inoculation recommendations for mycorrhizal fungi, and fertility management to produce plants with a high root/shoot mass ratio.

The fast growing roots of many species make deep containers (> 12 inches) and early transplanting advisable. Plants in deep containers will require less frequent watering than plants grown in shallow containers. Inoculation with symbiotic organisms may be very important for survival, as mycorrhizae play an important role in the ability of these plants to survive water and nutrient stress (Allen 1989, Bloss, 1985).

Conventional nursery practices are designed for maximizing growth rate and reducing the cost of holding stock. This can be accomplished by supplying nitrogen and other essential elements in the irrigation solution or as a solid fertilizer source amended into the potting mix. These practices may depress or prevent symbiont activity and may produce plants prone to failure in outplantings (St. John 1988). Consequently a variety of fertility management approaches will be tried. Both fast and slow-release type fertilizers will be examine at low (mimicking natural site fertility) and high levels of amendment. Plant growth, root/shoot ratio, and foliar levels of growth critical elements such as N and P will be determined. Plants grown under different fertility regimes will be transplanted into the field and subsequent establishment and growth will be followed.

Transplanting Techniques: Most of the perennial desert plants native to California Deserts can be transplanted successfully. Plants should be hardened off before planting, by gradually increasing exposure to full sun and reducing water. The rate at which this can be done is not known for most species. Experiments may be necessary to develop a hardening protocol so that the investment in growing container plants is not wasted.

More recently, techniques for transplanting larger, deeply rooted trees and shrubs have been developed. These involve: cutting side roots, watering while new roots develop, under cutting, and boxing. This is costly but success rates have been very high (Ruffner et al. 1985). An advantage of this technique is that the soil biota associated with the plant is also introduced to the site. These larger plant-soil islands may serve as dispersal centers for seeds and soil organisms such as mycorrhizal fungi speeding site recovery. A feasibility study is proposed to

determine if this technique could be successfully used at Castle Mountain for the transplant of well established wildings.

General Site Concerns: Irrigation and Fertilization

Research Objectives

Determine irrigation requirements for the establishment of plants by direct seeding and transplant.

Determine whether soil fertilization is necessary to achieve acceptable plant establishment and growth

Determine whether soil shaping and contouring will increase soil moisture storage and thereby aid plant establishment

Evaluate mulching requirements for plant establishment

Water is the single most important factor limiting growth and establishment in the desert. When water is available, nutrient limitations become apparent. Although irrigation may be available for some locations such as the leach pads, the areas prepared for revegetation should be shaped to employ water collecting strategies used in other desert regions to enhance plant establishment.

Shaping the ground to concentrate available rainfall has proven very effective in a number of desert systems (Evenari et al. 1982, McKell et al. 1979). Microcatchment basins have been studied in detail in the Negev Desert of Israel and guidelines are available to choose appropriate designs for selected species in given soils and climates (Shanan et al. 1970). Imprinting the desert soils with a shaped roller to form small basins that concentrate water has been very effective in some cases (Dixon 1985). Pitting machines can be used to leave a number of

discontinuous pits in the soil. The pits, by increasing surface roughness also reduce wind speed and facilitate sand deposition in the pits (Jordan 1981). This deposition can improve natural revegetation by capturing blowing seeds.

It is proposed that a series of experimental plots should be established where the roughness of the soil surface has been increased . The primary objective of this study will be to determine if soil moisture storage is increased by soil surface roughness.

Irrigation Techniques

Several different systems for drip irrigation and sprinkler type have been used in the desert. A recent report of plant growth patterns of Mojave Desert shrubs in response to rainfall provides information that may be useful for designing irrigation strategies. This 10 year study found that the germination and growth of annuals was controlled by the amount of rainfall between late September and January (Turner and Randall 1989). The minimum rain threshold for growth by annuals was 26 mm and for shrubs, 21 mm.

There are a number of irrigation options open for testing and use at the Castle Mountain site. The final decision should depend on costs of the irrigation system, their overall effectiveness, and water availability. Virginia and Bainbridge (1990) are testing irrigation systems for Caltrans to revegetate borrow pits in the California Sonoran Desert near the Salton Sea. Methods under evaluation include pitcher irrigation, pipe irrigation, and the use of wicks and other materials to provide moisture for prolonged periods during early plant establishment.

Studies will be established to examine soil moisture distribution with the irrigation systems selected for use. Plant survival and growth will be assessed on the irrigated sites and compared to control plots. Irrigation systems may also be used in the nursery for the production of container plants.

Fertilization

The need for fertilization prior to direct seeding or transplanting will depend on the fertility of the growth media distributed across the site. Soil analyses for each plant community type should be made prior to disturbance to determine typical nutrient levels for mature communities. There is little information about the fertilizer needs for establishment of desert plants. Some studies suggest that fertilizer can reduce survival in difficult environments, however, general statements cannot be made (Virginia and Bainbridge 1988).

A series of field experiments will be conducted. Plots will be amended with different fertilizer sources and amounts either to restore the growth media to natural soil fertility levels or to provide nutrients in excess of these levels. Fertilizer amendment levels will be based on soil nutrient analyses for each plant community type. Soils will be collected from beneath the canopies of shrubs and from the unvegetated interspaces between shrubs to account for the high spatial variability in soil properties that typifies deserts (Schlesinger et al. 1990, Virginia and Jarrell 1983). In addition to soil analyses the foliage of dominant species used in the revegetation plan will be analyzed for concentrations of growth limiting elements such as N and P. This will establish baseline nutrient levels for plants and soils. Tissue samples will be collected from plants at the revegetated sites to determine if nutrient deficiencies are suggested by abnormal tissue nutrient concentrations.

Herbivory

Newly established seedlings are often the most succulents plant available to herbivores. Rodents and insects may prove fatal to new plants unless protection is provided (Kay 1978, Kay and Graves 1983). Methods to mechanically protect transplants will be evaluated. Examples of materials available to protect seedlings and small container stock include a variety of wire or plastic screen materials, including some that photodecompose at controlled rates to eliminate the need to remove the protective screen from the plant as it grows larger.

Mulches

Mulches can aid plant survival and establishment by providing a number of benefits: control weeds, reduce evaporation, increase infiltration, concentrate rainwater, reduce erosion, and improve plant microclimate (Gray and Leiser 1982, Kay 1975).

The type and rate of mulch application will be tested as part of the direct seeding and transplant trials. The effectiveness of the mulch in increasing soil moisture and plant establishment or growth will be assessed. Mulching options include hydromulches, straw, rock mulches (grouping large stones to protect seedlings), and permeable plastic mulches and geotextiles.

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GUIDELINES FOR THE DEVELOPMENT

OF

A REVEGETATION PLAN

Prepared for Environmental Solutions, Inc.
Irvine, CA 92718

by

CALIFORNIA DESERT STUDIES CONSORTIUM
Department of Biology
California State University, Fullerton
Fullerton, CA 92637
714-773-2428

INTRODUCTION

The Castle Mountain Project proposes to develop a gold mine which will employ the open pit heap leach method of mineral extraction. The mine operators, Viceroy Gold Corporation of Las Vegas, NV plan to operate the mine for approximately 10 years. Operation beyond 10 years will depend upon economic factors in relation to the concentration of gold that remains at the site.

The Project site is located in the Lanfair Valley of northeast San Bernardino County in a portion of the long-established Hart Mining District. The nearest communities are Searchlight, NV, 22 miles to the northeast and Nipton, CA the same distance to the northwest. The Nevada state line is 7 miles to the east.

This report presents a description of the information required and steps to be followed in developing a plan for restoration of the vegetation on 900 acres at the mine site. The statements contained in this report are the result of a partial review of literature on revegetation of disturbed desert lands, visits to the Castle Mountains Project site, inspection of an ongoing revegetation plan currently being developed at a heap leach mine site in southeastern California, consultation with a specialist in Mojave Desert vegetation, as well as the Consortium staff's knowledge of desert plant ecology and distribution. The report includes a discussion of the kinds of areas which will require revegetation, issues to be resolved at each area, the information needed to resolve these issues, and a discussion concerning establishing goals for revegetation.

AREAS TO BE REVEGETATED

The Project site contains four distinct areas to be revegetated and the choice of plant material and the preparation of the sites for revegetation will necessarily differ from one area to another. These areas include:

1. Heap leach pads. At the conclusion of the mining operation, there will be four pads, the largest of which will be approximately one mile long, 1/3 of a mile wide and 80 feet high. The pads will consist of crushed ore, 80% of which will vary in size up to 3/8". Some of the ore particles will be agglomerated. The pads will have been subjected to thorough soaking during and after mineral extraction, with the expectation that little or no mineral nutrients remain for use by plants. The pads are expected to occupy an area of 330 acres.
2. Overburden sites. These will occupy an equally significant area at the mine site and consist of coarse rock, together with some finer particles and limited amounts of soil. Including the site designated South Clay Pit, the overburden piles will occupy an area of approximately 325 acres.
3. Undesignated roads. There are numerous unpaved mine haul roads at the site, some of which have been in use for decades, and have well-compacted surfaces. Some are on level ground, others on slopes; some are adjacent to existing vegetation, others course through disturbed barren areas. The Project proposes to construct

additional access and haul roads, some of which will remain as roadways, while others will be available for revegetation.

4. Support facilities. Crushers, gold recovery buildings, offices, shops, ponds and storage structures are scheduled for removal at the completion of the Project and are therefore candidates for revegetation. Except for areas which may have received unanticipated soil contamination, the revegetation problems will be similar to other areas of compacted soil such as the haul roads.

TOWARD A REVEGETATION PLAN

In order to develcp a revegetation plan, planners need to collect and analyze some significant kinds of information in order to detail what needs to be done and to establish goals for the revegetation process.

1. The existing plant assemblages and their habitats. What is the composition of vegetation at the mine site and in the surrounding vicinity? Using standard techniques of vegetation analysis, there is a need to determine species composition, density, cover and relative abundance of the plant species currently present, and to identify specific plant assemblages and indicator species, especially as they occur in relation to soil type, soil composition, slope, drainage, microhabitats and other physiographic features. A survey documenting the relationship of soils to plant cover will be essential.

2. Vegetation and revegetation history. Using existing records, old photographs and possibly the recollection of local residents, it is possible to reconstruct the nature and rate of revegetation at known sites in the immediate vicinity. The sites known to be available for use at the present time include a railway berm near Barnwell, abandoned in 1923; the South Clay Pit adjacent to the mine site which is no longer being worked; and the townsite of Hart, known to have been abandoned since 1918. Analysis of these, and perhaps other sites, will provide a valuable guide to the kinds of native and exotic vegetation that have been successful in recolonizing the area after disturbance and the conditions under which natural revegetation has occurred. One can also gather some data points on the rate of natural revegetation and, where possible, attempt to compare revegetation results after 70 years, as at Hart, with the vegetation composition and density in comparable but undisturbed locations.

This information on existing vegetation patterns and on the nature and rate of natural revegetation will provide important benchmarks in order to establish goals for some of the revegetation sites. However, before a revegetation plan can be formulated, additional kinds of information must be gathered.

3. Availability of water. Some successful revegetation efforts at desert sites have required irrigation in the earliest years. Planners must, therefore, know the volume of water that will be available from the existing on-site wells for revegetation tests during the mining operation,

and for revegetation after mining has ceased: the water quality at each water source; and the most feasible means of distributing water to nursery and revegetation sites concurrently with mine operations and after mining has ceased.

4. The need for topsoil. Use of topsoil may be very desirable in revegetating the overburden areas and the leach pads. Therefore, the revegetation plan will need to estimate the volume of topsoil required at each overburden site and leach pad and the amount that can reasonably be extracted and stockpiled on site.

5. The selection and treatment of plants. Based on information gathered above, a review of the literature on revegetation of disturbed desert areas and on-site experimentation, revegetation planners will be able to determine the following: What local species can be used for revegetation? Which existing plant species can be economically transplanted, stockpiled and used for seed sources or transplanting at a later date, or both and which are best obtained from commercial nurseries. Which seeds can be harvested? What special soil or soil nutrient requirements exist for each species to be used? What specific procedures, including the use of seeds or seedlings, appropriate seedling length or shoot/stem ratios, planting, irrigation and fertilizer schedules are required for successful establishment of each kind of species to be used. What kind of shelter, e.g., greenhouse or lathhouse is most suitable for stockpiling

plants and for rearing seedlings before transplanting. What are the best uses of vegetation which must be removed, but not used for nursery stock or transplanting? What kind of soil pre-treatments are needed for the compacted mine haul roads and what kinds of treatments, such as mulches, are most suitable for retaining soil and water within the top layers of the leach pads and overburden piles? How best to minimize the impact of herbivory from insects and mammals on seedlings and transplanted species? How best to provide shade and wind protection for seedlings? How to restore an algae crust layer? With irrigation will come the germination of exotic weeds. How can these be controlled and still provide water for revegetation? These questions can be answered by on-site experimentation while the mine is operating and the answers will provide the information required so that a revegetation plan and timetable can be developed and the cost of its implementation established on a yearly basis.

6. Contouring the landscape. Based on available information in the literature and information to be gathered during the plant survey, the overburden piles and the leach pads should be contoured in order to establish drainage patterns, slope faces and microhabitats capable of supporting a diversity of plant species and, eventually, faunal habitats. There should be consideration of the development of catch basins and microcatchments.

7. Special problems of the heap leach pads. The heap leach pads are designed to be very porous, are underlain by an impermeable membrane and, by virtue of their height, the finer particles may be subject to the erosional forces of wind. The pads, therefore, present special challenges to successful revegetation.

To determine the requirements for heap leach pad revegetation, planners will need to determine: the extent to which organics and residual minerals that affect plant growth remain, the special techniques found to be successful in revegetation at other heap leach desert mining sites; and the extent to which fertilizers and soil additives will be required for revegetation.

With this information from on-site and near-site surveys, and project site plant growth tests, planners will be in a position to prepare the revegetation plan. This plan should include the number, location, and distribution of each species of plant to be established, their growth requirements in terms of watering, fertilizing, shade, etc., and a timetable for their planting, and care. The plan should also include concrete suggestions for contouring to promote revegetation, and water conservation as well as microhabitat establishment.

To insure the lasting success of this effort, the revegetation plan should include specifications for a long-term monitoring program, which could identify and correct problems as they appear, and insure that the goals that were established were being met.

Goals for the revegetation of the Castle Mt. Project must, both comply with federal, state and county requirements (See Appendix I) and be cognizant of the level of funding that can reasonably be allocated for this purpose. While some of the specific goals can only be established after a local survey and on-site experimentation have taken place, other goals can be established earlier. In this latter group, we offer the following:

1. The implementation of the revegetation plan should demonstrate a good faith effort to revegetate each of the four kinds of sites.
2. Revegetation should involve the exclusive use of native plant species known to occur in the East Mojave Desert and active exclusion of exotic species throughout the duration of the revegetation effort, to the extent practicable.
3. The revegetation plan should provide not only for the planting and transplanting of diverse plant species, but should prepare each kind of site in such a way as to enhance the likelihood of successful natural revegetation.
4. The revegetation plan should contribute to improving the viewscape by the elimination of rock scars caused by excavation and road cuts. This can be accomplished by integrating revegetation plans with those for the application of rock coloring and contouring.
5. The revegetation plan should include the provision of microhabitats which would provide cover and nesting opportunities for desert vertebrates.

6. The revegetation plan should develop quantitative goals in terms of plant diversity and density which can reasonably be expected once the mining operation has ceased, the revegetation plan implemented and a reasonable number of years has elapsed to permit natural revegetation to occur.

Legal requirements for revegetation.

There are federal, state and county regulations requiring reclamation of mined lands. Revegetation, along with contouring, erosion control and other treatments is categorized as one kind of reclamation.

Federal reclamation requirements are contained in 43 CFR Chapter 11 (10/1/87 edition), subpart 3809.0-5(j) and 3809.1-3(d)(4). These standards, which are the implementation of federal law, define reclamation as the "taking of such reasonable measures as will prevent unnecessary or undue degradation... ...including...revegetating disturbed areas so as to provide a diverse vegetative cover." Unnecessary or undue degradation means "surface disturbance greater than what would normally result when an activity is being accomplished by a prudent operator in usual, customary, and proficient operations of similar character and taking into consideration the effects of operations on other resources and land uses..." And, elsewhere, this document states that "Reclamation shall include, but shall not be limited to ...(iv)...revegetation of disturbed areas, where reasonably practicable..."

The California Surface Mining and Reclamation Act of 1975 and the California Surface Mining and Reclamation Rules require reclamation of mined lands and state that "the reclamation of mined lands...will permit the continued mining of minerals and will provide for the protection and subsequent beneficial use of the mined and reclaimed land" and "adverse environmental effects are

prevented or minimized and that mined lands are reclaimed to a usable condition which is readily adaptable for alternative land uses." SMARA further states (section 3503(a)(1) that "the removal of vegetation and overburden, if any, in advance of surface mining shall be kept to the minimum" and (e) "grading and revegetation shall be designed to minimize erosion and to convey surface runoff to natural drainage courses or interior basins designed for water storage." In (f) SMARA states that "the use of soil conditioners, mulches, or imported topsoil shall be considered where revegetation is part of the reclamation plan and where such measures appear necessary" and in (g) when the reclamation plan calls for revegetation the available research addressing revegetation methods and the selection of species having good survival characteristics, for the topography, resoiling characteristics, and climate of the mined area shall be used."

As the lead agency for enforcement of SMARA, San Bernardino County has established regulations governing reclamation as a part of the San Bernardino County Development Code, Division 12, Chapter 1, Sections 812.0101, 812.0115(a).

These county regulations require that "(a)...mined lands are reclaimed to a usable condition which is readily adaptable for alternative land use" and in (e) "The reclamation of mined lands...will provide for the protection and subsequent beneficial use of the mined and reclaimed land."

FINAL 4/12/90

GS/REVEGE

APPENDIX D

CLOSURE AND POST-CLOSURE PLAN

CASTLE MOUNTAIN PROJECT
CLOSURE AND POST-CLOSURE PLAN

Prepared for:
Viceroy Gold Corporation

Prepared by:
Steffen Robertson and Kirsten (U.S.), Inc.
3232 South Vance Street, Suite 210
Lakewood, CO 80227

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SRK Project No. 11503

TABLE OF CONTENTS

		Page No.
1.0	INTRODUCTION	1
1.1	Project Facilities Description	1
1.2	Scope	2
2.0	INTERIM CLOSURE	4
2.1	Procedures Associated with the Heap Leach Area	4
2.2	Procedures Associated with the Process Plant	5
2.3	Procedures Associated with Overburden Disposal Areas	5
3.0	FINAL CLOSURE	6
3.1	Procedures Associated with the Heap Leach Area	6
3.2	Procedures Associated with the Process Plant	9
3.3	Procedures Associated with Overburden Disposal Areas	10
4.0	RECLAMATION	11
5.0	CLOSURE COST ESTIMATES	12
5.1	Costs Associated with the Heap Leach Area	13
5.2	Costs Associated with the Process Plant	14
5.3	Costs Associated with Overburden Disposal Areas	15
5.4	Closure Costs After 2 and 4 Years, and at Final Closure	15
5.5	Bond Amount	16

TABLES

5.1	Closure Costs After 2 Years	17
5.2	Closure Costs After 4 Years	18
5.3	Closure Costs at Final Closure	19
5.4	Incremental Closure Costs	20

FIGURES

Figure K.1 Location Map
Figure K.2 Extent of Heap Leap Facilities After 2 Years of Operation
Figure K-3 Extent of Heap Leap Facilities After 4 Years of Operation
Figure K-4 Extent of Heap Leap Facilities at Final Closure

1.0 INTRODUCTION

1.1 Project Facilities Description

The Castle Mountain Project proposed by Viceroy Gold Corporation (VGC) will be an open pit mining and processing operation. An estimated 17 million tons of gold bearing ore and 25.5 million tons of overburden will be mined over the initial six year period. An estimated 30 million tons of ore may be mined over the project life. The project, as shown in Figure K.1, is located in San Bernardino County in the Castle Mountains on both patented and unpatented lode claims. The unpatented claims include 2,620 acres of land administered by the Bureau of Land Management (BLM) in T14N, R17E, Sections 13, 23, 24, 25, and 26. Both the BLM and San Bernardino County have jurisdiction with regard to approval of land uses and post-mining reclamation plans within the Castle Mountain Project area.

The project is located within the Hart Mining District. The general facilities arrangement is shown in Figure 1B of the Castle Mountain Project, Heap Leach Facilities Design Report, to which this Closure and Post Closure Plan is appended. The operation will involve mining of up to three ore bodies. Ore will be crushed, agglomerated, and stacked on a lined leach pad in layers or "lifts" of 20-ft thickness. Gold will be leached from the ore with a dilute sodium cyanide solution.

The leach solution system will consist of three 500,000 gallon steel tanks and a lined overflow pond. An additional lined pond will provide storage for stormwater inflows. Collected solution will be transported by gravity flow to the solution storage tanks, Pregnant solution will be pumped to the process area where gold will be extracted by carbon adsorption. Barren and intermediate leach solutions will be pumped back to the leach piles to extract additional quantities of gold. Following the completion of leaching

of gold from a given lift, another 20 ft of ore will be placed and leaching will resume. The ultimate height of the leach pad may reach 80 ft.

Overburden removed to expose gold ore in the three mine pits will be placed in the South Overburden Area (Figure 1B). In addition to the South Overburden Area, overburden will be placed on patented land in the existing South Clay Pit. This area will be reclaimed by the Operator as part of the project reclamation program.

A number of ancillary facilities will be required for the operation of the project. These include access haul roads, surface water drainage control, electric power supply, water source and supply, sanitary and solid waste disposal and security and administration facilities.

1.2 Scope

This Closure Plan addresses the decommissioning of those parts of the Castle Mountain Project which fall under jurisdiction of the Colorado River Water Quality Control Board (CRWQCB). These features include heap leach facilities, process areas, and overburden rock disposal areas. Protection of surface water and groundwater are the primary concern of CRWQCB with respect to project decommissioning and closure. Other aspects of reclamation are addressed in the reclamation plan prepared by VGC for submission to San Bernardino County to meet the intent and requirements of the California Surface Mining and Reclamation Act of 1975 (SMARA).

The plans committed to in this report meet the requirements set forth in California Administrative Code Title 23, Chapter 3, Subchapter 15, Article 8, Closure and Post-Closure Maintenance. As specified in Article 8, the post-closure maintenance period will extend until treatment is complete which, in the case of the Castle Mountain Project, will coincide with the completion of heap rinsing

and detoxification. Closure procedures will be under the direct supervision of a registered civil engineer or certified engineering geologist. In addition, this Closure Plan has been prepared under the direct supervision of a California registered professional engineer and forms part of the overall submission to the CRWQCB for a waste discharge permit.

This report includes a description of interim closure procedures to be implemented in the event of a short term (less than six months) project shutdown (Section 2.0), as well as a description of procedures to be implemented by the Operator at the time of final closure (Section 3.0). Decommissioning procedures related to final closure are discussed, and closure cost estimates are given. In addition, closure costs associated with operator walk off, leaving the state to bear the burden of closure, are discussed.

CRWQCB will set a bond amount based on the worst case closure costs and will hold this bond for the life of the project. This plan is intended to meet the needs of all the potential closure situations mentioned above.

2.0 INTERIM CLOSURE

The interim closure procedures outlined in this section would be implemented in the event of a temporary project shutdown. Should a shutdown exceed six months, the final closure procedures described in Section 3.0 would be implemented.

In general, interim closure procedures are designed to protect the environment from pollutant contamination during any type of project shutdown. These procedures include control and containment of process solutions from the leach pad and ponds, as well as those from the process plant. Surface drainage will be an important aspect of interim closure, as will active on-site maintenance and monitoring. Because final closure activities will present a worst-case scenario with regard to closure costs, no separate interim closure cost estimate has been prepared. The bond amount for final closure will be more than adequate to cover the relatively minor costs of interim closure.

2.1 Procedures Associated with the Heap Leach Area

At the time of interim closure, the drip irrigation and solution pumping system would be shut off and process solutions in the heap would be allowed to drain into the solution tanks and ponds. The volume of solution in the ponds that would drain to the pond would be approximately 2.5 million gallons in addition to the 900,000 gallons of working volume. The total 3.4 million gallons of solution would be treated so that it could be used for rinsing the pile. The top of the heap would be piped to allow for sprinklers so that solution evaporation and ultraviolet exposure would be maximized. The increased makeup water will further dilute the solutions being used for rinsing.

Routine environmental monitoring would continue throughout the shutdown period and would be supplemented with routine water quality parameter monitoring of solution pond water (including pH). The system of collection and interceptor ditches around the heap leach area would remain functional during an interim shutdown, thus alleviating the need to institute other means of surface water control.

2.2 Procedures Associated with the Process Plant

As described in the previous subsection, process solutions would be drained into the solution tanks and the entire system would be cleaned and flushed. Likewise, chemicals used in the gold recovery circuit would be flushed from the system and surplus chemicals would be sealed and stored in secured areas. All machinery in the process area would be periodically checked and routine maintenance and servicing of machinery would be continued throughout the shutdown period. Interceptor ditches around the process area would continue to function in the same manner as during active operations. Thus, no additional surface water control would be necessary.

2.3 Procedures Associated with Overburden Disposal Areas

The primary issues of concern with regard to the overburden disposal areas are surface drainage and stability. The surfaces of overburden disposal areas will be regraded inward from slope crests at a minimum grade of 0.5 percent. This will provide for protection against erosion of disposal area slope faces. Monitoring of surface drainage and stability would be performed as part of the interim closure program.

3.0 FINAL CLOSURE

At the end of the estimated 10-year project life, final closure and reclamation procedures will be implemented by the Operator at the Castle Mountain Project site. The closure procedures will be formulated such that subsequent to complete implementation, no pollutants or contaminants will remain on site in a form that could be released to the surrounding environment. The closure techniques to be employed will leave the site in a condition requiring no additional long-term maintenance and posing no hazard, either short- or long-term, to water quality or other elements of the environment. Furthermore, when viewed in concert with proposed reclamation procedures, final closure will result in a productive ecosystem allowing multiple uses of benefit to mankind, wildlife, and plant communities.

3.1 Procedures Associated with the Heap Leach Area

Once the leaching cycle is complete on the final lift of the heaped ore, the spent ore will be treated to decrease the concentration of process chemicals and constituents contained both in the interstitial pore water of the heap and on the surface of the spent ore. In general, it is the residual cyanide level in the ore that is the determining factor in terms of reaching an acceptable waste classification. A number of methods for cyanide degradation and detoxification exist, ranging from passive abandonment (in which the cyanide in the heap is allowed to naturally degrade over time), to rinsing of the heap with water, to fairly intensive chemical treatment with agents such as hydrogen peroxide (which destroy cyanide more rapidly than do the more "natural" treatments).

It is anticipated that a 60-day rinsing cycle using pumped groundwater will be sufficient to reduce residual cyanide in the heap to an acceptable level. Recirculation of fresh makeup groundwater and leftover solution water will continue through most of the 60-day cycle. Approximately 5 days from the end of the rinse

cycle, the addition of fresh makeup water will be halted, thus allowing most of the circulating fluids to evaporate during continued pumping and application to the heap. Should the rinsing cycle prove less effective than anticipated, chemical treatment utilizing hydrogen peroxide oxidation, will be employed. The use of a chemical treatment process will be discussed with, and approved by CRWQCB prior to its implementation.

Prior to dismantling the solution tanks and ponds after the 60-day rinse cycle, samples of the rinsed spent ore will be collected from the surface, bottom, and at quarter points in the heap (i.e., one-quarter, one-half, and three-quarters of the way through the heap). A waste classification test run at pH 5.5 using carbonic acid to simulate conditions of natural rainwater leaching will be conducted on this material to determine whether the rinsing cycle has indeed resulted in adequate heap detoxification. As discussed previously, the potential exists that chemical treatment may be required if rinsing of the heap has not achieved the desired results, although this event is not believed to be likely.

Water balance calculations indicate that at the end of the 60-day rinse cycle most of the solution will have evaporated from the heap and ponds. Pumping and sprinkling of tank or pond water will continue until the minimum pumping depth anticipated at 6 to 8 inches, is reached. The remaining solution will be allowed to evaporate, thus eliminating any discharge from the heap leach facility. Upon the completion of the evaporation process, the sludge remaining in the tanks or ponds will be allowed to air-dry to a semi-solid state, and then be removed from the ponds and taken to an appropriate off-site disposal facility. Because it is anticipated that the sludge will be classified as a hazardous waste, proper disposal and transport methodology will be required as will deposition of the sludge in a licensed low-level hazardous waste facility.

Following the removal of sludge from the tanks or ponds, the tanks will be removed, the HDPE liners will be freed from the anchor trenches, folded in on themselves, and covered with a minimum of 20 ft of fill material, consisting primarily of overburden. Final grading of the pond surface will result in the reestablishment of approximate pre-mining contours, thus providing for natural drainage of the pond site.

Heap edges or outslopes will be regraded to cover perimeter berms after detoxification is complete. Outslopes will be reduced from the operational configuration of 1.5H:1V lift slopes with 15-ft wide benches, to an average 2.5H:1V slope. Graded material will extend outward far enough to cover the perimeter berm and ditches that encircled the heap during active operations.

Stabilization of the post-closure heap landform will be achieved through the regrading and slope reduction discussed in the preceding paragraph. Given the final 2.5H:1V average slope configuration, the spent ore of the heap will be stable. Some mounding of the top of the heap will be included during regrading activities. This will serve a dual purpose: 1) small scale reduction of visual contrast with surrounding landforms, and 2) creation of microsite hollows and depressions for revegetation purposes.

Because the closure procedures outlined on the preceding pages will essentially remove the potential risk of contaminant exposure from the mining and processing of gold ore, the need for continued monitoring will be minimal. Monitoring of surface water, and vadose zone, will take place throughout the life of the project, as required by Article 5 of Subchapter 15 (California Administrative Code Title 23, Chapter 3). Throughout the closure and reclamation period, visual inspections of each disturbance area will be made on a frequent basis. Thus, should any abnormal situations arise, they will be observed and dealt with in a timely manner. It should

further be noted that it will be to the Operator's advantage to be meticulous in reporting and dealing with any potential concerns, in order to obtain bond release soon after decommissioning.

3.2 Procedures Associated with the Process Plant

As discussed in the preceding subsection, process solutions will be evaporated concurrently with heap rinsing and detoxification. Any excess solutions from the gold recovery circuits will be pumped into the tanks and applied to the heap to be evaporated with the heap leach solution.

For the most part, reagents used in the process are packaged in leak-resistent containers for safe shipping and storage. Any surplus reagents, including cyanide, remaining in sealed containers at the time of closure will be shipped back to the manufacturers via approved transport. Unsealed, partially-used reagent containers will be dealt with on an individual basis. Nonhazardous or nontoxic reagents may be hauled to a local landfill, whereas toxic and hazardous chemicals will be dealt with accordingly and shipped to facilities licensed to dispose of them. None of the reagents will be buried or disposed of on site.

All process buildings and facilities will be removed from the project site and salvaged. As will be discussed in Section 5.2, the salvage value of the process facilities will offset demolition costs. Subsequent to the removal of all facilities, the process area will be regraded to reestablish natural drainage.

At final closure of the project, all on-site roadways and roadside surface water control structures will be regraded and drainage patterns will be reestablished.

3.3 Procedures Associated with Overburden Disposal Areas

Ultimately, the overburden disposal areas and mined-out pits will be the largest component for closure of the Castle Mountain Project. Key to the closure operations will be the necessity to leave these facilities in a stable walk-away condition.

Slopes within the overburden disposal areas will be regraded where necessary to achieve an overall slope not exceeding 2H:1V. In some portions of the overburden disposal areas, flat benches will alternate with slopes of 1.5H:1V to achieve the overall 2H:1V slope.

The pits created during the mining process will be left open at the conclusion of the operation. Should standing water accumulate for any extended period of time, waste rock analyses indicate that water quality would not become a major concern in terms of toxicity to the wildlife that might utilize the ponded water.

The upper surfaces of the overburden disposal areas will be regraded inward from the crests at a minimum slope of 0.5 percent. This will ensure that erosion of reclaimed disposal area slopes will be minimized. Regrading and revegetation of the South Clay Pit Reclamation Area is expected to be completed in the early stages of the project operation.

4.0 RECLAMATION

Significant overlap exists between the goals and intent of this Closure and Post-Closure Plan and the Reclamation Plan being prepared to comply with SMARA. Most reclamation/closure plans on public lands share the same primary objectives:

1. Eliminate erosion problems, conditions posing a hazard to humans and wildlife and provide a stable surface for revegetation;
2. To reestablish, to the extent possible, the vegetation and habitat types that existed prior to disturbance; and
3. To achieve visual compatibility.

Because the focus of this Closure Plan is on stability and maintenance of water quality both during and after closure, little information has been provided with regard to the implementation of revegetation efforts and the consideration of land use issues. These concerns fall under the jurisdiction of SMARA and will be addressed in detail in the reclamation plan. The Operator will conduct a revegetation test project in order to identify the best methods and plant materials. The County and BLM will jointly hold a bond for the reclamation and revegetation of the Castle Mountain Project. This bond will be completely independent of the CRWQCB bond.

The Operator anticipates the that bonding for reclamation purposes will be reviewed with the appropriate agencies annually as the stages of operation progress. The bond amount would be determined by the anticipated reclamation cost for areas disturbed during any given year or stage of operation.

5.0 CLOSURE COST ESTIMATES

It is necessary, for the purpose of estimating closure costs and subsequent setting of bond amount, to plan for the contingency that the Operator "walks away" from the project leaving the burden of closure on the State. In this event, certain procedures which would have been implemented under a sequenced Operator-controlled decommissioning are not applicable for this "worst case" scenario. No actual chemical treatment of heap process solution is thought to be necessary under an Operator-controlled closure.

Tables 5.1 through 5.3 present a detailed breakdown of projected closure costs in two-year increments of project operation. Figures K.2 through K.4 illustrate the projected heap leach facility configurations at each time increment. Table 5.4 summarizes the incremental increases in closure costs which result from an increase in disturbed area as mining operations proceed. Estimated costs shown in Tables 5.1 through 5.3 are costs based on experience in similar projects for equivalent tasks. On the basis of information presented in Table 5.1, VGC requests that CRWQCB set the bond amount for the construction period at the amount in this table less costs for solution detoxification, heap rinse/detox and raw water makeup. These items would be removed from the bond amount for this initial period since no material will be placed on the heap during the approximately seven month long construction period. Prior to the end of the construction period the bond amount would be increased to cover the items previously excluded. The bond amount for an initial period of two years and that the bond amount will be reevaluated every two years thereafter for the life of the project.

5.1 Costs Associated with the Heap Leach Area

Following the cessation of leaching, a 60-day rinse/detoxification cycle will be required. Rinsing costs are calculated on the basis of two 150 horsepower (hp) pumps operating at 3,000 gpm for the full 60-day rinse cycle. Based on a rating of 0.7 KWhr/hp and using a power cost of $0.07 KWhr/hp, pumping costs will be approximately $350.00/day for a total cost of $21,120.00. Raw makeup water is expected to cost $150/day for a total cost of $8,250.00.

During the rinse/detoxification cycle, rinse solutions will evaporate. At the end of the 60-day cycle, the remaining rinse solution will drain from the leap to the solution ponds and tanks. A lump sum of $100,000.00 will be provided to cover the treatment costs of the rinse/detoxification solution.

Once the solution has been neutralized and evaporated, the accumulated sludge must be removed. For the purposes of cost estimation and based on previous experience, it has assumed that approximately 9 cu yds of sludge will be produced from each one million tons of ore processed. Because this sludge is likely to be classified as a hazardous waste requiring special handling, transport, and disposal in a licensed facility, a cost of $7.96/cu yd has been estimated for loading and short-term hauling. Hauling and disposal of sludge in a licensed, off-site facility is estimated to cost $200/ton.

Following sludge disposal, the three solution tanks will be removed from the site. The salvage value of these tanks is expected to offset the cost of removal. The liner in the solution ponds will then be folded in upon itself and buried under at least 20 ft of overburden material and the pond surface will be regraded to provide for drainage.

Liner freeing and folding is expected to require one day of work with a crew consisting of two laborers, a backhoe, and backhoe operator, at an estimated cost of $600. Burial of the pond will require the placement of 65,000 cu yds of overburden material at a unit cost of $1.50/cu yd, resulting in a total cost of $97,500.

Regrading of the heap top surface will cost approximately $100/acre. Heap side slopes will be regraded to cover perimeter berms and collection ditches, and to provide stability. Regrading of side slopes is estimated to cost $0.25/cu yd.

5.2 Costs Associated with the Process Plant

Costs for removal of structures and machinery in the process areas are expected to be offset by salvage values. Concrete foundations and footings will be demolished and buried on-site at an estimated cost of $75/cu yd. The process areas will be regraded at an estimated cost of $100/acre.

Costs associated with the removal of surplus process chemical reagents will be offset by the manufacturers' refunds on returned sealed containers. Open containers will be dealt with on an individual basis.

On-site roadways, including the overland conveyor alignment, and roadside surface water control structures will be regraded at an estimated cost of $100/acre.

5.3 Costs Associated with Overburden Disposal Areas

Regrading the overburden disposal areas for the purposes of stability and drainage away from the outslopes will not require substantial movement of overburden material. A cost of $100/acre has been estimates for regrading of disposal area surfaces.

5.4 Closure Costs After 2 and 4 Years of Project Operation, and at Final Closure

As mining operations proceed, the costs for closure of the Castle Mountain Project will increase as the overburden disposal areas and the heap leach facility increase in size.

The estimated cost for closure of the project after two years of operation is shown in Table 5.1. The extent of the heap leach facility after 2 years of operation is shown in Figure K.2.

After two years of operation, it is estimated that the heap leach facility will cover 25 acres. The South Overburden Disposal Area and the South Clay Pit Reclamation Area will cover 80 and 24 acres, respectively. By the end of the initial two year period, construction of all process areas and on-site roadways will be complete. On-site roads will cover an estimated 17 acres. The process areas will cover approximately 15 acres.

The total cost for project closure after 2 years of operation is estimated to be $398,898.

After four years of operation, the heap leach area will cover approximately 45 acres. The South Overburden Disposal Area and the South Clay Pit Reclamation Area will cover 130 and 24 acres, respectively.

At this time the extent of the heap leach facilities is as

shown in Figure K.3. The estimated cost for closure of the project after 4 years is shown in Table 5.2. The estimated closure cost after 4 years of operation is $431,690.

After approximately 6 years of operation, closure of the initial heap will commence. At this time the heap leach facility will cover approximately 87 acres. The South Overburden Disposal Area will cover approximately 210 acres.

The extent of heap leach facility at final closure is shown in Figure K.4. The estimated cost for final closure is $476,388. Incremental closure costs or the bond amounts required to cover closure operations for each time period, are shown in Table 5.4.

5.5 Bond Amount

In conclusion, the required bond amount for worst case closure costs, on the basis of the costs estimated above, is $398,978 for closure after two years of project operation. This amount represents the costs for closure should the operator "walk away" at that time. A bond in the above amount will provide the State of California and the CRWQCB with sufficient funds to close the Castle Mountain Project under any circumstances. Additional bonding will be discussed with the appropriate State agency prior to the start of subsequent two year time periods based on the incremental costs shown in Table 5.4.

TABLE 5.1

CLOSURE COSTS AFTER YEAR 2
VICEROY GOLD CORPORATION
CASTLE MOUNTAIN PROJECT

AREA/TASK	UNIT	QUANTITY	UNIT COST ($)	SUBTOTAL ($)
South Overburden Disposal Area				
Regrade	Acre	80	100.00	8,000
South Clay Pit Reclamation Area				
Regrade	Acre	24	100.00	2,400
Process Areas				
Foundation Demolition and Burial	Cu yd	1750	75.00	131,250
Regrade	Acre	15	100.00	1,500
Heap Leach Facility				
Regrade Heap Slopes to Bury Ditches	Cu yd	59600	0.25	14,900
Regrade Heap Surface	Acre	25	100.00	2,500
Heap Rinse/Detox	Days	60	352	21,120
Fold in Pond Liners	LS			600
Sludge Handling	Cu yd	29.8	7.96	238
Sludge Haul & Disposal	Ton	49.7	200	8,940
Fill Pond with Overburden	Cu yd	65000	1.50	97,500
Solution Detoxification	LS			100,000
Raw Water Makeup	Days	55	150	8,250
On Site Roads				
Regrade	Acre	17	100.00	1,700
				$398,898

TABLE 5.2

CLOSURE COSTS AFTER YEAR 4
VICEROY GOLD CORPORATION
CASTLE MOUNTAIN PROJECT

AREA/TASK	UNIT	QUANTITY	UNIT COST ($)	SUBTOTAL ($)
South Overburden Disposal Area				
Regrade	Acre	130	100.00	13,000
South Clay Pit Reclamation Area				
Regrade	Acre	24	100.00	2,400
Process Areas				
Foundation Demolition and Burial	Cu yd	1750	75.00	131,250
Regrade	Acre	15	100.00	1,500
Heap Leach Facility				
Regrade Heap Slopes to Bury Ditches	Cu yd	99300	0.25	24,825
Regrade Heap Surface	Acre	45	100.00	4,500
Heap Rinse/Detox	Days	60	352	21,120
Fold in Pond Liners	LS			600
Sludge Handling	Cu yd	81	7.96	645
Sludge Haul & Disposal	Ton	122	200	24,400
Fill Pond with Overburden	Cu yd	65000	1.50	97,500
Solution Detoxification	LS			100,000
Raw Water Makeup	Days	55	150	8,250
On Site Roads				
Regrade	Acre	17	100.00	1,700
				$ 431,690

TABLE 5.3

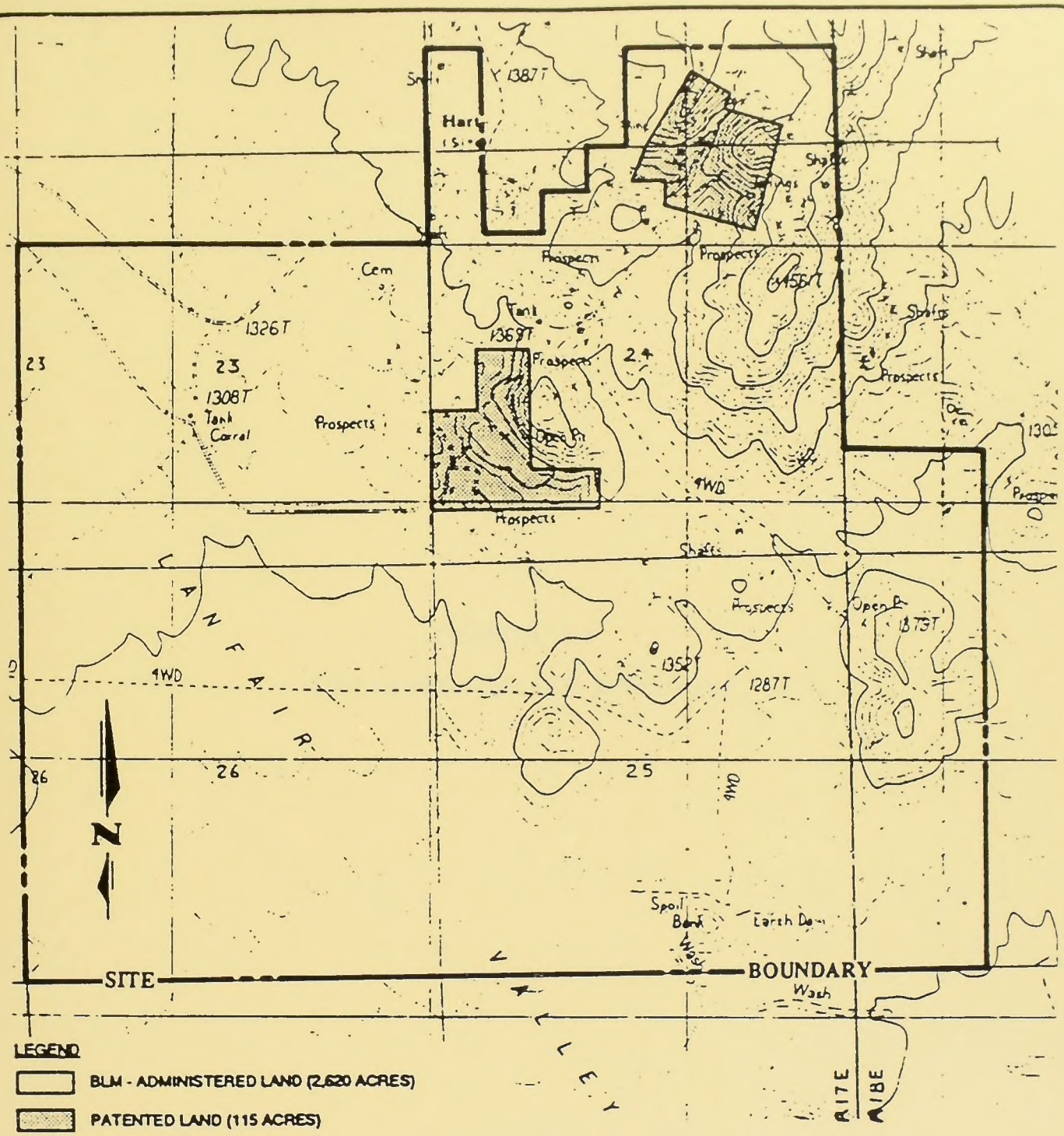
CLOSURE COSTS AFTER YEAR 6 (CLOSURE OF INITIAL PAD)
VICEROY GOLD CORPORATION
CASTLE MOUNTAIN PROJECT

AREA/TASK	UNIT	QUANTITY	UNIT COST ($)	SUBTOTAL ($)
South Overburden Disposal Area				
Regrade	Acre	210	100.00	21,000
South Clay Pit Reclamation Area				
Regrade	Acre	24	100.00	2,400
Process Areas				
Foundation Demolition and Burial	Cu yd	1750	75.00	131,250
Regrade	Acre	15	100.00	1,500
Heap Leach Facility				
Regrade Heap Slopes to Bury Ditches	Cu yd	140600	0.25	35,150
Regrade Heap Surface	Acre	87	100.00	8,700
Heap Rinse/Detox	Days	60	352	21,120
Fold in Pond Liners	LS			600
Sludge Handling	Cu yd	153	7.96	1,218
Sludge Haul & Disposal	Ton	230	200	46,000
Fill Pond with Overburden	Cu yd	65000	1.50	97,500
Solution Detoxification	LS			100,000
Raw Water Makeup	Days	55	150	8,250
On Site Roads				
Regrade	Acre	17	100.00	1,700
				$ 476,388

TABLE 5.4

INCREMENTAL CLOSURE COSTS

TIME PERIOD (Years)	CLOSURE COSTS ($)	INCREMENTAL CLOSURE COST ($)
2	398,898	398,898
4	431,690	32,792
6 (closure)	476,388	44,698



LEGEND

- BLM - ADMINISTERED LAND (2,620 ACRES)
- PATENTED LAND (115 ACRES)

0 .5 1 MILE

SCALE

LEGAL DESCRIPTION:

T. 14 N, R. 17E, SB&M
SEC. 13: S 1/2 OF SE 1/4 AND W 1/2 OF SW 1/4 OF SW 1/4
SEC. 23: ALL, EXCEPT N 1/2 OF N 1/2
SEC. 24: ALL, EXCEPT E 1/2 OF NW 1/4 OF NW 1/4, AND NW 1/4 OF NE 1/4 OF NW 1/4
SEC. 25: ALL; SEC. 26: ALL

T. 14 N, R. 18E, SB&M
SEC. 19: SW 1/4 OF SW 1/4
SEC. 30 W 1/2 OF W 1/2

PROJECT NO. 11503	PREPARED BY: STEFFEN ROBERTSON & KIRSTEN (U.S.) Consulting Engineers & Scientists	**FIGURE K.1** CASTLE MOUNTAIN PROJECT PROJECT SITE
DATE 03/90		
REVISION 0		

APPENDIX E

LIST OF PERMITS AND APPROVALS

APPENDIX E

LIST OF PERMITS AND APPROVALS

PERMIT/APPROVAL	AGENCY OR APPROVING AUTHORITY	PURPOSE
FEDERAL		
Plan of Operations	Bureau of Land Management	Mine and Reclamation Plan Approval.
Environmental Impact Statement	Bureau of Land Management	Environmental Compliance.
Cultural Resource Permit	Bureau of Land Management	Section 106 Investigation.
Right-of-Way Easement or Special Use Permit	Bureau of Land Management	Electric power and water line rights-of-way.
Purchase and Storage of Explosives Permit	Department of Justice, Bureau of Alcohol, Tobacco, and Firearms	Purchase of explosives in one state for use in another.
Emergency Fire, Evacuation and Rescue Plans (55.4-39.B)	Department of Labor, Mine Safety, and Health Administration	Separate plans required for surface and underground operations.
Notice of Start of Operations	Department of Labor, Mine Safety, and Health Administration	Notice must be filed prior location and ownership.
Legal Identity Report	Department of Labor, Mine Safety, and Health Administration	Report on type of operation, location and ownership.
Record of Inspection of Self-Propelled Equipment (55.9-1)	Department of Labor, Mine Safety, and Health Administration	Must be maintained for six months and available to inspectors.
Record of Testing the Resistance of Electrical Ground System (55.12-28)	Department of Labor, Mine Safety, and Health Administration	Test required annually and after installation, repair, or modification. Record of tests must be available to inspectors.
Miner Training Plan (Title 30, Subchapter H, Part 48, Subpart B)	Department of Labor, Mine Safety, and Health Administration	Training by certified instructors is mandatory for all personnel.

PERMIT/APPROVAL	AGENCY OR APPROVING AUTHORITY	PURPOSE
STATE OF CALIFORNIA		
Waste Discharge Permit	Colorado River Basin Regional Water Quality Control Board	Surface and ground water quality control.
Ground Water Well Installation on State Lands	State Land Commission	Rights to install wells on State lands.
COUNTY OF SAN BERNARDINO		
Environmental Impact Report	San Bernardino County Land Management Department	Environmental Compliance.
Site Approval	San Bernardino County Land Management Department	Consistency with planning/ zoning.
Grading Plan Approval	San Bernardino County Department of Building and Safety	Compliance with appropriate codes and standards.
Building Plan Approval	San Bernardino County Department of Building and Safety	Compliance with appropriate codes and standards.
Building Permits	San Bernardino County Department of Building and Safety	Fire safety, building safety, compliance with appropriate codes and standards.
Approval of Mining/ Reclamation Plan	San Bernardino County Land Management Department	Satisfaction of Surface Mining and Reclamation Act.
Water System Permit	San Bernardino County Department of Environmental Health Services	Supply, storage, and distribution. System design, water quality.
Sewage Disposal System Permit	San Bernardino County Department of Environmental Health Services	Location, design, percolation rates for septic tanks and underground leaching fields.
Purchase and Use of Explosives	San Bernardino County Sheriff	Proper storage and handling, possibly bonding.

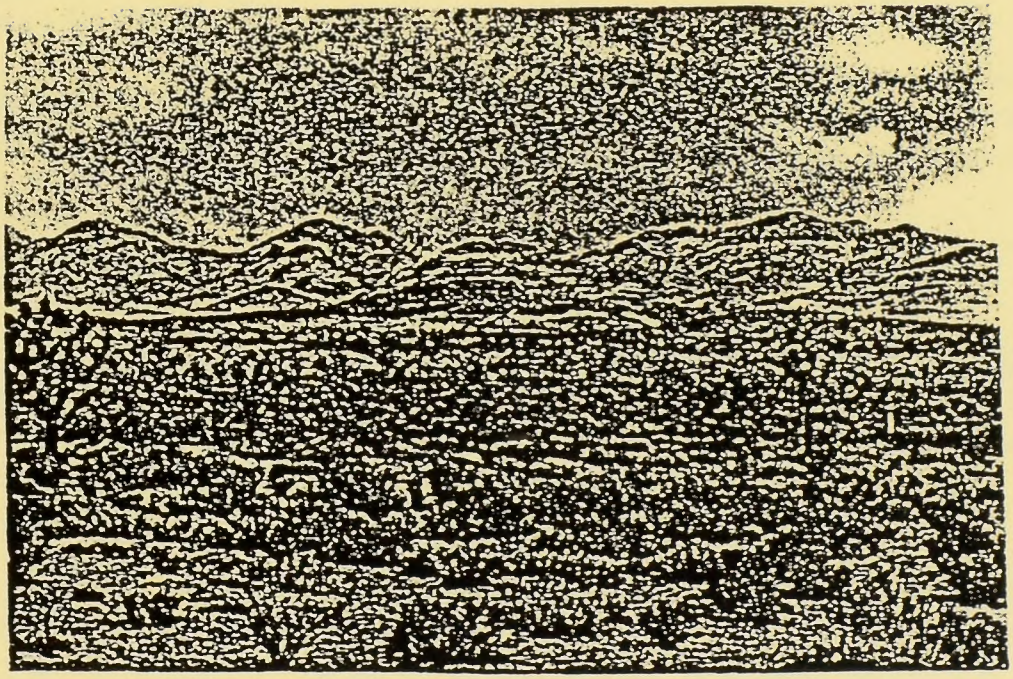
PERMIT/APPROVAL	AGENCY OR APPROVING AUTHORITY	PURPOSE
COUNTY OF SAN BERNARDINO (Continued)		
Water Well Permit and Inspection	San Bernardino County Department of Environmental Health Services	
Authority to Construct	San Bernardino County Air Pollution Control District (APCD)	Air pollution source location and control.
Permits to Operate	San Bernardino County APCD	Air pollution emissions, monitoring, and reporting.

APPENDIX F

SOIL SURVEY FOR THE CASTLE MOUNTAIN PROJECT

GREYSTONE
Development Consultants, Inc.

SOIL SURVEY
FOR THE
CASTLE MOUNTAIN PROJECT



Prepared For:

VICEROY GOLD CORPORATION
Las Vegas, Nevada

November, 1989

5990 Greenwood Plaza Blvd. • Suite 104 • Englewood, CO 80111
(303) 850-0930

INTRODUCTION

A soil survey was conducted for Viceroy Gold Corporation's Castle Mountain project in San Bernadino County, California (Figure 1). The project area is located approximately 60 miles south of Las Vegas, Nevada, in the Castle Mountains (T14N, R17E). The objectives of the survey were to determine the salvageable depths and volumes of suitable soil within the proposed surface disturbance areas and to determine if there is sufficient quantity of soil material for use in reclamation.

Elevation in the permit area range from 4,200 to 4,950 feet above mean sea level (m.s.l.), and physiography consists of mountain slope and plane and terrace land form categories. Average annual precipitation is less than eight inches, and average annual air temperature between 60 and 65 °F.

Area soils area generally fairly shallow but typical of desert soils. These soils area formed on the recent alluvial fans which were derived from Tertiary volcanics. Textural classes range from sands to clays. Soils area shallower along upper slopes and fans and deeper on lower terraces and drainage bottoms.

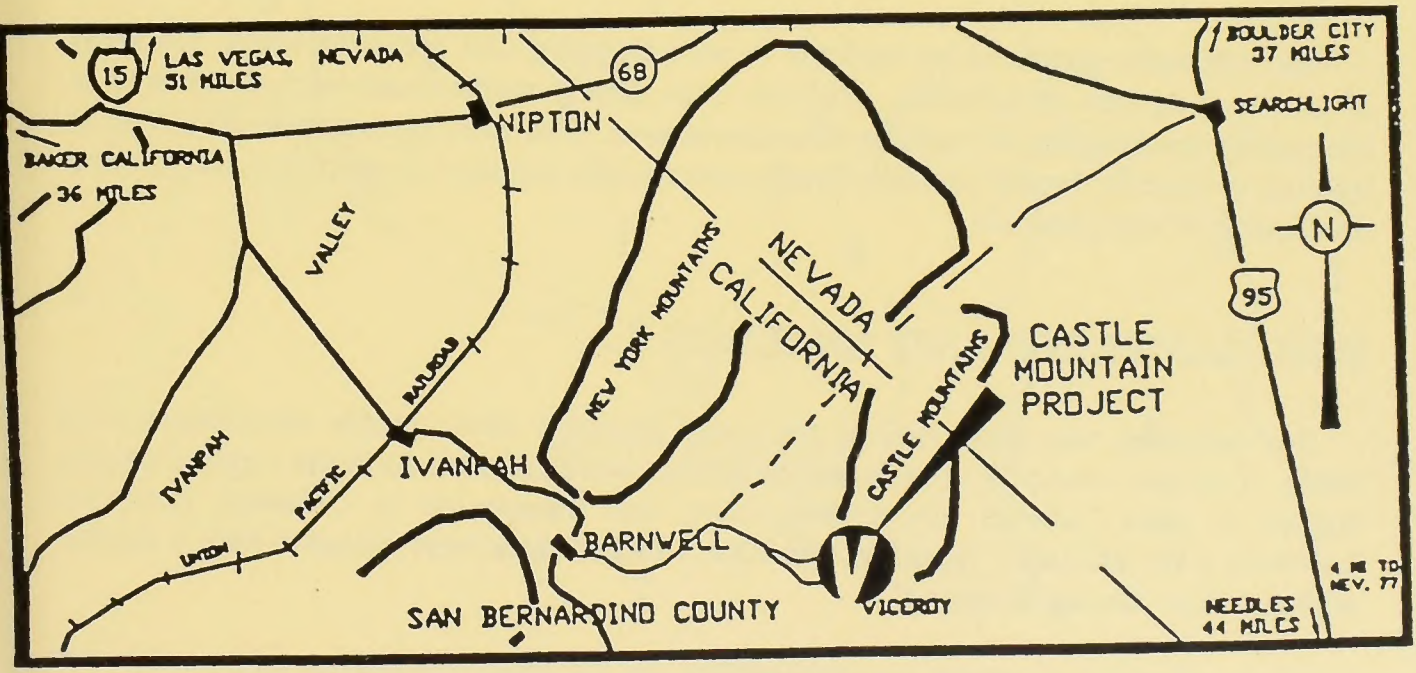


Figure 1. PROJECT LOCATION

METHODS

The soil survey was designed and conducted to be consistent with the National Cooperative Soil Survey. Generally, this study consisted of soil mapping, soil sampling and analysis, and suitability determinations for topsoil salvage.

SOIL MAPPING

Utilizing the results of previous soil studies in the area, analysis of topographic conditions, aerial photographs, vegetation types, and geologic features, preliminary soil mapping unit boundaries were delineated within the permit area. A field study was then conducted within the areas proposed for surface disturbance in order to refine the preliminary mapping unit boundaries.

Soil units were mapped as consociations or complexes. The series phases were based on texture, slope, erodibility, coarse fragments, depth, or other diagnostic parameter. A soils map was prepared on a topographic base with proposed disturbance areas outlines. Figure 2 contains designations for each mapping unit delineation, as well as soil sample site locations.

Test pits were excavated by backhoe in each mapping unit occurring within the areas of proposed surface disturbance. Pit sites were clearly marked and were distributed to adequately characterize the surface disturbance area. Pits were excavated to 60 inches or bedrock to describe typical profiles. Profile descriptions included the thickness and physical description of each horizon.

SOIL SAMPLING AND ANALYSIS

Soil sampling was conducted at the same locations where profile descriptions were made. Two quart samples of each genetic horizon were collected form the exposed profile; bagged in clean, labeled polyethylene bags; and transported to Colorado Analytical Laboratory for analysis. Horizons less than 3 inches thick were included with a similar, adjacent layer during sampling.

Each collected soil sample was analyzed for the following parameters: pH; particle size (texture); saturation percentage; conductivity; soluble calcium, magnesium, and sodium; sodium adsorption ratio; and organic matter. Nitrogen, phosphorus, and potassium levels were also determined. Laboratory analyses were performed in accordance with the standard procedures referenced in the lab report contained as an appendix to this report.

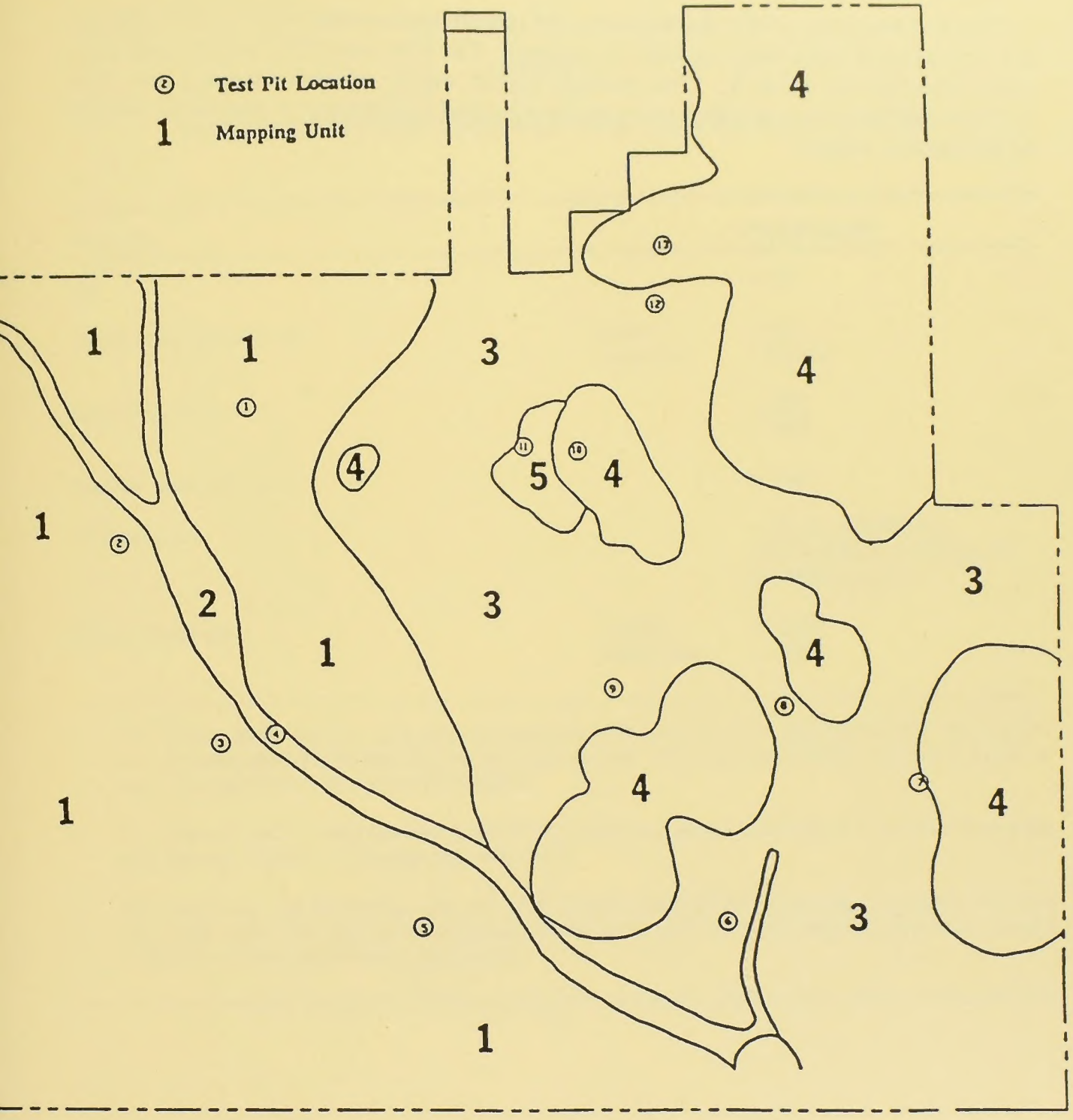


Figure 2. SOILS MAP, CASTLE MOUNTAIN PROJECT

TOPSOIL SUITABILITY DETERMINATIONS

The soil mapping, profile descriptions, and sample analysis data were used to describe the suitability of each mapping unit for salvage. Chemical suitability criteria used were those identified in Table 1. The average topsoil depths of each mapping unit were multiplied by the corresponding acreages of proposed disturbance to determine volumes of salvageable topsoil.

TABLE 1

UNSUITABILITY CRITERIA FOR SOIL OR SOIL SUBSTITUTES

Parameter		Suspect Level[1]
pH		< 5.5
Conductivity (mmhos/cm)	Surface	> 4.0
	Subsurface	> 4.0-8.0[2]
Saturation percentage		> 85% < 25%
Sodium absorption ratio		> 15.0
Textural Class		c, sc, sic, cl(735% c), sicl (> 35% c, < 15% s), sil (< 15% s), si, ls, s
Coarse fragments	Surface	> 20%[3]
	Subsurface	> 35%[3]

[1] The suspect levels are used as a guide in evaluating the suitability of a soil material for reclamation. An evaluation should take into account the 'total system'. Interactive parameters may either nullify or verify the significance of a potential problem.

[2] The actual maximum acceptable salt level will depend on the plant species proposed in the revegetation plan and the potential for upward salt movement.

[3] The values may vary depending upon the plant species proposed for revegetation in specific locations (e.g. a soil with a very high coarse fragment content throughout its profile may be completely salvaged if used for certain shrub or tree plantings).

RESULTS

SOILS DESCRIPTION

Soil Series Descriptions

Descriptions of the soil series occurring in the permit areas are presented below. These soils include soils that are primarily shallow to moderately deep and of igneous and volcanic origin. These descriptions were taken from the "Soils Inventory, East Mojave Planning Unit" (1976) which was prepared by the Bureau of Land Management (BLM) and the University of California, Riverside.

ROUGH BROKEN LAND

The rough broken land occurs on moderately steep (9 to 30%) to very steep (60+%) slopes on old alluvial landscapes. These areas are highly dissected and rapidly eroding. The surface contains 40 to 90 percent coarse fragments, ranging from gravel to cobbles. Textures range from moderately coarse to medium surfaces and coarse to moderately fine substrate. Soil depth varies from shallow to moderately deep. Also areas with large percentages of rock outcrops are included in this unit. Inclusions of areas which are not dissected with drainage ways and occurring on gently sloping areas make up approximately 20 percent of this unit. Erosion hazard is severe because of slopes and shallow soils.

RIVERWASH

The riverwash is found in the study area in the major avenues of drainage. Because of its topographic position it is most commonly on the lower portions of alluvial fans adjacent to major stream courses. Smaller stream courses of this type occur as inclusions within the larger associations in higher topographic positions. Due to random deposition in the stream course, lenses of differing texture within the material make the textural profile of this type highly variable. Generally, this soils contains a stony surface with coarse fragments. Erosions susceptibility is severe because of its position in major drainage ways.

GRAVELLY SANDY LOAM

This consists of shallow to moderately deep, moderately coarse textures, well-drained soils formed in mixed calcareous alluvium. They occur on nearly level to gently sloping alluvial fans.

Surface textures range from sandy loam to silt loam. Surface coarse fragments range from gravelly to cobbly. Colors are pale brown or very pale brown. The texture of the substratum varies from gravelly very fine sandy loam to loam with colors of pale brown or very pale brown. Depth to horizon of high calcium carbonate content varies from soft to extremely hard. Soils are moderately to strongly alkaline and calcareous.

This soil occurs on undulating alluvial fans at elevations of 2,500 to 5,500 feet. Slope gradients range from 0 to 8 percent. The soils formed in alluvium are high in calcium carbonate and derived mainly from igneous rocks.

COBBLY LOAM

This series consists of shallow to moderately deep sandy clay loams, silt loams, clay loams, well-drained soils. They have developed on nearly level to gently sloping older alluvial fans of mixed geologic origin. They are characterized by a developed B horizon.

These soils have a wide textural range in the surface soil, loamy sands to silt loams. Cobbles and stones cover 50 to 90 percent of the surface. The subsurface B horizon is often subdivided into 2 or 3 parts depending on degree of development. Colors vary from a reddish yellow to a strong brown with textures varying from heavy sandy loams to heavy clay loams. Clay films form as bridges between grains. The substratum is characterized by either a C horizon of loamy sand sot gravelly sands or by a sandy loam calcareous horizon. Most profiles are highly effervescent throughout.

These soils are located primarily on older fan remnants at the base of mountain ranges. They occur at elevations of 2,000 to 5,000 feet. Disruption of the stable surface condition with the developed vesicular crust would increase the erosion susceptibility of this area.

VOLCANIC SLOPE SOIL

This soil consists of moderately deep soils, having sandy loam textures and occurring on moderately steep to steep hills. These soils are well drained. The soil is usually covered with 70 to 95 percent cobbles and stones. Rock outcrops are present, covering 10 to 30 percent of the surface. Inclusions of deep soils and soils with slopes less than 9 percent make up approximately 25 percent of this mapping unit. Elevation ranges from 2,000 to 5.000 feet. Depth of bedrock ranges from 20 to 40 inches.

COARSE, SHALLOW SOILS

This soil type consists of shallow, coarse to moderately coarse textured, excessively drained soils. These soils occur on steep to very steep mountains. The soils area usually covered with 60 to 90 percent of the surface. Depth to bedrock varies form 6 to 20 inches. This unit occurs at elevations of 2,000 to 7,000 feet. Inclusions of deep soils

and soils with slopes less than 31 percent make up approximately 25 percent of this mapping unit. Erosion potential is severe.

Mapping Unit Descriptions

Figure 2 exhibits the soil map that was prepared for the Castle Mountain Project. Four basic mapping units were identified on the site. These units were delineated based on similarities in salvageable soil depths and chemical characteristics. The following descriptions outline the general characteristics of these units and include a typical profile description of each. Photographs of each typical profile are exhibited in Figure 3.

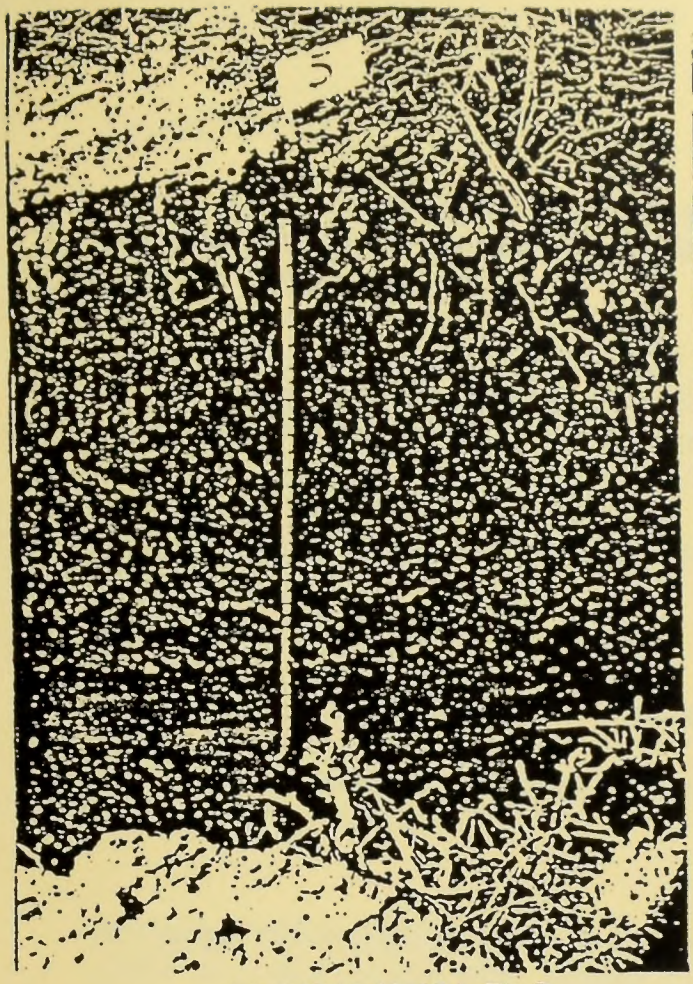
MAPPING UNIT 1

This mapping unit occurs on the gently sloping and nearly level lands in the western portion of the permit area. Slopes range from zero to 10 percent. Primarily this unit contains the gravelly sandy loam and the cobbly loam soil types that were described earlier. The predominant type is the gravelly sandy loam but other types occur as inclusions.

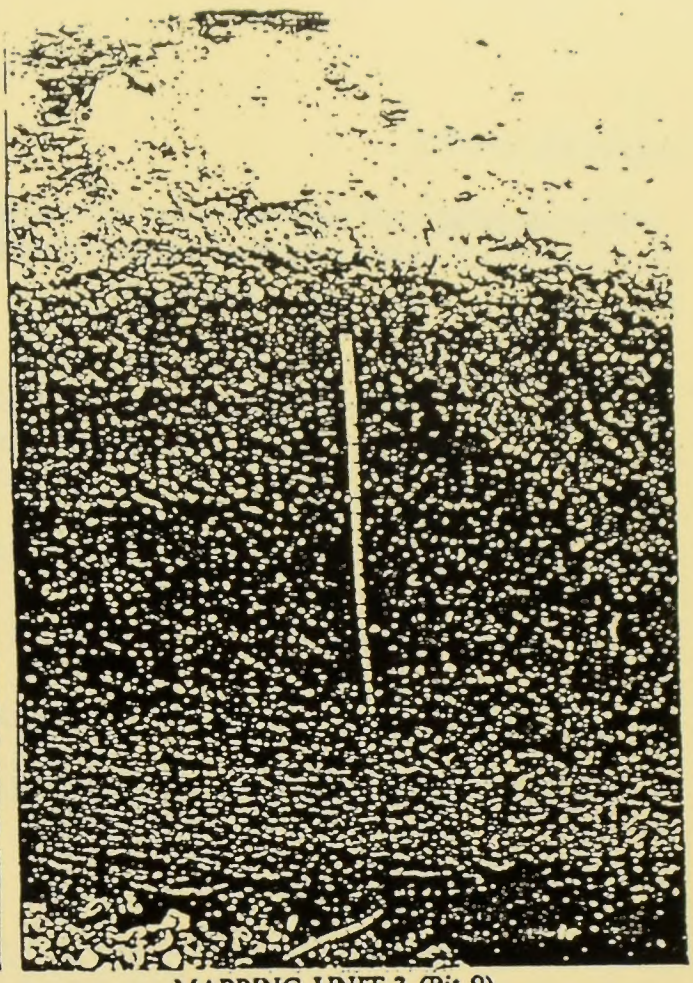
The soil in this unit generally has a gravelly sandy loam surface layer two to eight inches thick. The soil surface is covered with gravel (60 to 90 percent). The next horizon is a sandy loam or loam 12 to 18 inches thick with moderate to high gravel content. This is followed by a light colored layer which is very firm and high in calcium carbonate. Texture in this layer ranges from a clay loam to sandy loam. This is underlain by a layer of loamy sand approximately 12 to 24 inches thick which is, in turn, underlain by an alluvial bedrock.

Pit 5 exhibited a soil profile somewhat characteristic of this type:

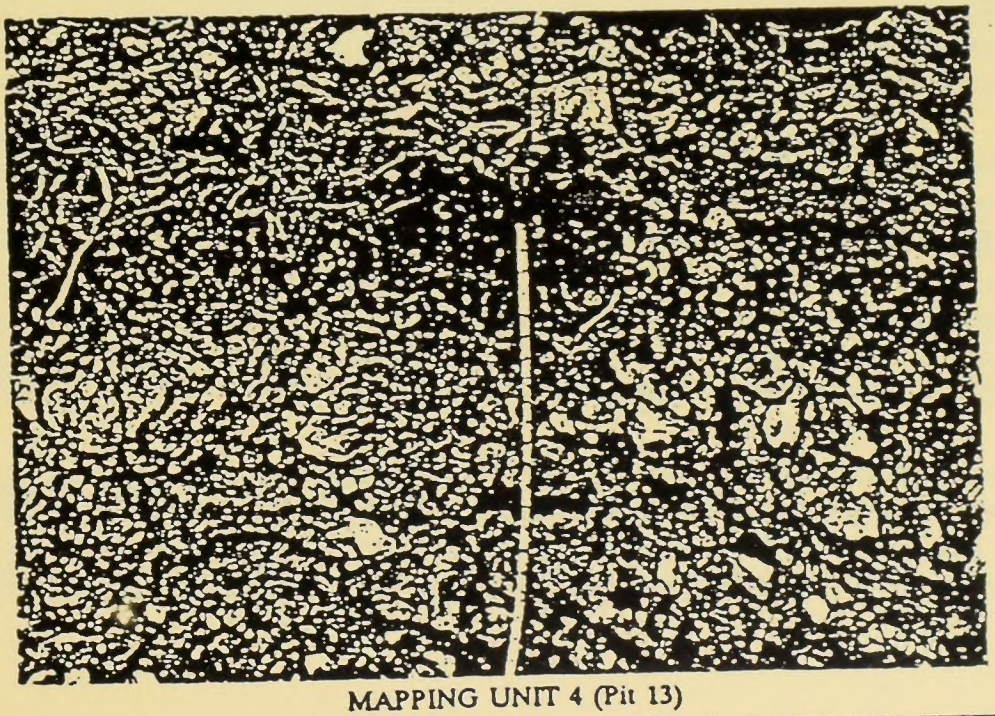
0 to 5 inches	-	gravelly sandy loam, surface covered nearly 75 percent with gravel, very weak platy structure crumbling to granular
5 to 18 inches	-	gravelly loam, firm, very weak massive structure crumbling to granular
18 to 41 inches	-	very firm sandy clay loam, white color, strongly effervescent ($CaCO_3$)
41 to 51 inches	-	sandy loam, very coarse sand, loose
51 + inches	-	alluvial rock



MAPPING UNIT 1 (Pit 5)



MAPPING UNIT 3 (Pit 9)



MAPPING UNIT 4 (Pit 13)

FIGURE 3. Typical Profiles of Soil Mapping Units

MAPPING UNIT 2

This mapping unit occurs within the major drainages of the permit area. It is composed almost exclusively of the Riverwash soil that has been previously described. As noted earlier, this type varies considerably.

The soil in this type is generally very sandy. The surface layer is a loose sand about 12 inches thick with many stony fragments on the surface. This is underlain by approximately four feet of very gravelly coarse sand over a very hard, white rocky material at approximately 60 inches.

Pit 4 contained a typical profile of this type:

0 to 12 inches - sand, medium grain size, surface covered with many rocks, no structure

12 to 57 inches - very gravelly sand, coarse grain size, no structure

57 + inches - very firm loam, white color, strongly effervescent ($CaCO_3$)

MAPPING UNIT 3

This mapping unit occurs on the gently to moderately sloping lands at the foot of the Castle Mountains. Slopes range from five to 25 percent. The primary soil types within this mapping unit are the volcanic slope soil and coarse shallow soil that have been previously described. Also included in this unit are rock outcrops, cobbly silt loam, and small areas of the other soil types.

The soil in this unit generally has a very gravelly surface and a gravelly loam surface layer 6 to 12 inches thick. This is underlain by another layer 12 to 24 inches thick which is a very gravelly loam which is over a white rocky substrate.

Pit 9 exhibited a soil profile typical of this unit:

0 to 7 inches - gravelly loam, surface nearly 75 percent covered with gravel, no structure

7 to 24 inches - very gravelly loam, gravel size larger, weak massive structure

24 + inches - very hard loam, white color, strongly effervescent ($CaCO_3$)

MAPPING UNIT 4

This mapping unit occurs on the steep to very steep slopes of the Castle Mountains. Slopes range from 15 to 75 percent. This unit is composed of the coarse shallow soil and up to 70 percent rock outcrops.

Much of this unit has no measurable soil cover. Where soils exist, there is generally a loam to silty loam surface layer 4 to 12 inches thick over rock.

Pit 13 is typical of the soil found in this unit:

0 to 6 inches - gravelly silt loam, rocks and gravel abundant on surface, no structure

6 + inches - rock

MAPPING UNIT 5

This area is located where the current mine pit exists. It has been previously disturbed and, therefore, has no soil.

ANALYSIS RESULTS

Table 2 contains a summary of the laboratory analysis results of the samples taken at the various sampling points identified on **Figure 2.** A complete copy of the lab report is found in Appendix A.

The analysis results focus on both physical and chemical parameters of the soils. Generally, the chemical characteristics are within the acceptable limits for topsoil material outlined in **Table 1** with a few exceptions. The soils are moderately alkaline and only one sample exhibited even marginal salinity. Pit 1 (25-31) had an Electrical Conductivity (EC) of 7.3 mmhos/cm. Three samples exhibited sodium absorption ratios (SAR's) greater than 15.0 in subsoil layers. Each of these three horizons were high in clay content indicating that sodium is present in the projection soil environment and is held by the clay particles.

The physical parameters evaluated focused primarily on textural analysis. Textures varied from sand to clay. Nearly all of the soils present in the project area are gravelly and have a moderately high to high to high gravel content. While most of the soils exceed the general coarse fragment content limits, it is the best material available on site.

TABLE 2

CASTLE MOUNTAIN SOILS LABORATORY ANALYSES, 1989

Sample Site	Soil Horizon	Sand %	Silt %	Clay %	Texture	Org. Matter %	Saturation %	pH	EC mmhos /cm	Selected Common Ions (meg/l) Ca	Mg	Na	SAR
Pit 1	0-1	35	41	24	LO	0.69	38.0	7.8	1.7	5.37	3.16	9.71	4.7
	1-25	20	45	35	CLLO	0.50	48.1	8.2	2.8	2.36	1.10	30.31	23.0
	25-31	21	39	40	CLLO	0.33	54.8	7.6	7.3	4.74	3.77	55.94	27.1
Pit 2	0-6	63	27	10	SNLO	0.45	31.5	7.6	0.7	1.81	2.16	3.50	2.5
	6-30	63	25	12	SNLO	0.27	36.1	8.1	0.7	2.27	1.71	3.95	2.8
	30-46	68	20	12	SNLO	0.19	35.0	8.4	0.8	4.77	1.34	3.56	2.0
	46-60	82	12	6	LOSN	<.01	31.7	8.6	0.7	3.67	1.87	2.39	1.4
Pit 3	0-5	64	28	8	SNLO	0.64	37.6	7.7	0.7	2.12	1.85	3.02	2.1
	5-18	62	26	12	SNLO	0.32	36.8	7.8	0.4	1.35	1.93	1.10	0.9
	18-32	63	21	16	SNLO	0.20	33.3	8.4	0.8	3.66	1.70	3.71	2.3
	32-53	80	12	8	LOSN	0.03	27.3	8.6	0.6	3.61	1.95	1.33	0.8
Pit 4	0-12	88	8	4	SN	0.02	27.8	8.7	0.6	2.18	0.90	2.70	2.2
	12-57	88	6	6	SN	0.05	27.3	8.5	0.5	2.64	1.26	2.49	1.8
	57+	42	38	20	LO	0.42	38.4	8.4	0.7	4.77	1.62	2.08	1.2
Pit 5	0-5	54	34	12	SNLO	0.59	37.1	8.2	0.8	3.31	2.29	2.68	1.6
	5-18	50	32	18	LO	0.83	36.8	8.3	0.7	5.25	0.93	2.46	1.4
	18-41	49	21	30	SNCLLO	0.90	49.4	8.3	0.7	3.71	1.05	2.83	1.8
	41-51	80	10	10	SNLO	0.03	35.3	8.4	0.8	4.24	2.25	3.20	1.8
Pit 6	0-7	40	48	12	LO	1.02	40.7	7.6	0.6	1.88	1.87	0.88	0.6
	7-21	14	38	48	CL	0.50	69.6	8.4	2.0	1.73	0.77	19.60	17.6
Pit 7	0-9	33	47	20	LO	0.69	41.7	8.1	0.7	2.23	0.84	5.30	4.3
	9+	41	33	26	LO	1.19	36.1	8.4	0.7	0.75	0.18	6.76	9.9
Pit 8	0-13	32	54	14	SILO	1.07	36.5	8.0	0.7	4.28	1.06	2.76	1.7
	13-30	25	53	22	SILO	0.71	41.1	8.2	0.7	4.33	0.91	3.20	2.0
Pit 9	0-7	42	42	16	LO	0.80	38.4	7.8	0.8	2.96	1.38	2.45	1.7
	7-24	45	33	22	LO	0.57	40.9	8.3	0.7	3.06	0.96	3.85	2.7
	24+	45	29	26	LO	0.74	38.3	8.2	1.9	7.41	1.44	13.63	6.5
Pit 12	0-5	51	33	16	LO	1.18	43.7	8.3	0.7	3.91	1.13	2.68	1.7
	5-14	66	24	10	SNLO	0.29	37.0	8.3	0.8	5.39	0.95	3.15	1.8
	14-19	68	18	14	SNLO	0.36	37.1	8.2	0.8	3.95	0.87	4.33	2.8
Pit 13	0-6	28	56	16	SILO	1.40	38.4	7.7	0.8	2.90	1.87	3.46	2.2

VOLUME CALCULATIONS

From review of the soil pits and the sample analysis results, it was determined that each of the soil types have the following range and average salvageable depths:

	Range	Average
Mapping Unit 1	12 to 30 inches	18 inches
Mapping Unit 2	8 to 16 inches	12 inches
Mapping Unit 3	6 to 12 inches	8 inches
Mapping Unit 4	0 to 6 inches	0 inches
Mapping Unit 5	0	0

Figure 4 shows the soil map overlain with the proposed areas of surface disturbance. These areas include the mine pits, overburden piles, leach pads, and other facilities. The approximate acreages of each unit that would be disturbed are:

	Acres Disturbed
Mapping Unit 1	317
Mapping Unit 2	9
Mapping Unit 3	296
Mapping Unit 4	165
Mapping Unit 5	22

The disturbed acreages were multiplied by the average depth of salvageable soil to determine salvageable volumes. **Table 3** contains a summary of these volume calculations.

TOPSOIL REDISTRIBUTION

It is assumed that salvaged topsoil will be redistributed over the overburden piles, leach pads, and facility areas. The total acreage disturbed by these is approximately 809 acres.

If the salvaged soil is redistributed evenly over these areas, approximately 10.5 inches of soil cover would be achieved. It may be desireable to place more soil cover material in some areas than others due to such factors as the geochemistry of the rock, etc. If this is done, the salvaged material would be redistributed accordingly.

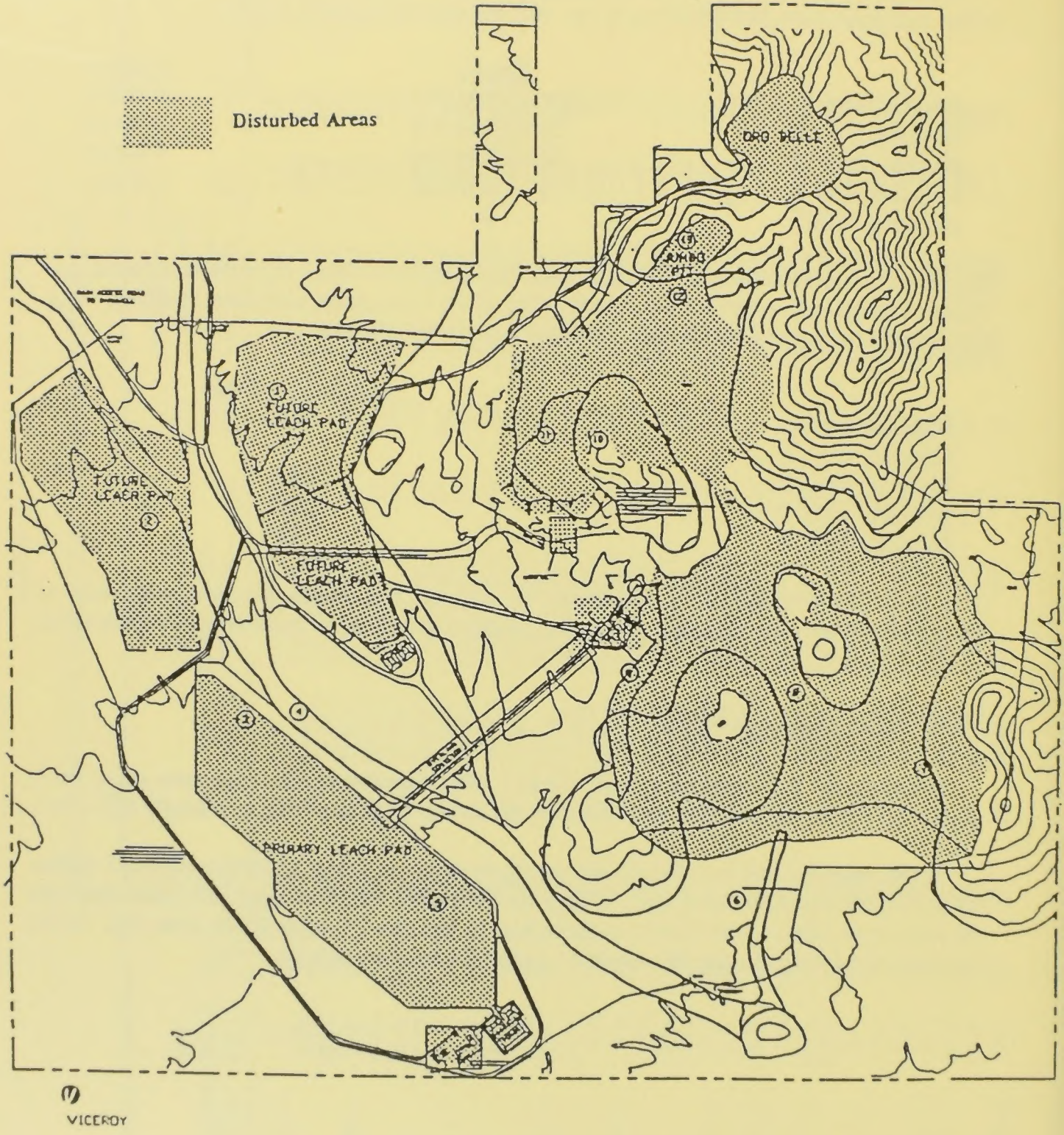


Figure 4. PROPOSED DISTURBANCE AREA, CASTLE MOUNTAIN PROJECT

TABLE 3

CASTLE MOUNTAIN PROJECT PREMINE SOIL ACREAGES, SALVAGE DEPTHS, AND AVAILABLE VOLUMES, 1989.

Map Unit	Disturbed Acreage	Salvage depth (inches)	Volumes (yd^3)
1	317	18	767,140
2	9	12	14,520
3	296	8	318,370
4	165	0	0
5	22	0	0
TOTAL	809		1,100,030

APPENDICES

COLORADO ANALYTICAL LABORATORY

SOIL WATER ENVIRONMENTAL

LABORATORY ANALYSIS REPORT

November 2, 1989

REPORT TO: Randy Schroeder

COMPANY: Greystone Developement Consultants
5990 Greenwood Plaza Blvd.
Suite #104
Englewood, CO 80111

PROJECT: 31 Soil Samples for Analysis: pH, E.C., SAR, N, P, K, Organic Matter, Texture and % Saturation
CAL Lab # 8733 - Samples Rec. 10-26-89

ANALYTICAL METHODS SYNOPSIS

Includes abbreviations (ABBREV) used for column headings, parameter name (PARAMETER), reporting units (UNITS), normal minimum reporting limit (MIN) and method synopsis (REFERENCE).

ASA-1 = "Methods of Soil Analysis - Agronomy No. 9"; Part 1; American Society of Agronomy; Black; 1965

ASA-2 = "Methods of Soil Analysis - Agronomy No. 9"; Part 2; American Society of Agronomy; Page; 1982

USDA-60 ="Diagnosis and Improvement of Saline and Alkali Soils"; U.S.D.A. Handbook No. 60; U.S. Salinity Laboratory Staff; 1954 (Reprinted 1969)

Method source cited will be followed by the chapter and section reference.

Summary of Abbreviations Used:

mm/cm = millimhos per centimeter

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ABBREV	PARAMETER	UNITS	MIN	REFERENCE
	Fractionation by Hydrometer	%	1	ASA-1 43.5
SN	Sand or Sandy	%	1	USDA Triangle
SI	Silt or Silty	%	1	" "
CL	Clay	%	1	" "
LO	Loam or Loamy	%	1	" "
pH	Hydrogen Ion Activity	units	.1	USDA-60 6(21a)
EC	Electrical Conductivity @ 25C	mm/cm	.1	USDA-60 6(3a,4b)
SAR	Sodium Absorption Ratio	units	1	USDA-60 pg. 26
NO3-N	Nitrate Nitrogen (available)	ppm	.1	ASA-2 33-6
P	Phosphorus (available)	ppm	.1	ASA-2 24-5
OM	Organic Matter	%	0.01	ASA-2 29-4
K	Potassium (available)	ppm	1	ASA-2 13-3
SAT	Water at Saturation	%	.1	USDA-60 6(27a)

Analysis Supervised By

Data Approved For Release By

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mple ID	Sand (%)	Silt (%)	Clay (%)	USDA Text.	OM (%)	SAT (%)
t 1 0-1	35	41	24	LO	0.69	38.0
t 1 1-25	20	45	35	CLLO	0.50	48.1
t 1 25-31	21	39	40	CLLO	0.33	54.8
t 2 0-6	63	27	10	SNLO	0.45	31.5
t 2 6-30	63	25	12	SNLO	0.27	36.1
t 2 30-46	68	20	12	SNLO	0.19	35.0
t 2 46-60	82	12	6	LOSN	<.01	31.7
t 3 0-5	64	28	8	SNLO	0.64	37.6
t 3 5-18	62	26	12	SNLO	0.32	36.8
t 3 18-32	63	21	16	SNLO	0.20	33.3
t 3 32-53	80	12	8	LOSN	0.03	27.3
t 4 0-12	88	8	4	SN	0.02	27.8
t 4 12-57	88	6	6	SN	0.05	27.3
t 4 57+	42	38	20	LO	0.42	38.4
t 5 0-5	54	34	12	SNLO	0.59	37.1
t 5 5-18	50	32	18	LO	0.83	36.8
t 5 18-41	49	21	30	SNCLLO	0.90	49.4
t 5 41-51	80	10	10	SNLO	0.03	35.3
it 6 0-7	40	48	12	LO	1.02	40.7
it 6 7-21	14	38	48	CL	0.50	69.6
it 7 0-9	33	47	20	LO	0.69	41.7
it 7 9+	41	33	26	LO	1.19	36.1
it 8 0-13	32	54	14	SILO	1.07	36.5
it 8 13-30	25	53	22	SILO	0.71	41.1
it 9 0-7	42	42	16	LO	0.80	38.4
it 9 7-24	45	33	22	LO	0.57	40.9
it 9 24+	45	29	26	LO	0.74	38.3
it 12 0-5	51	33	16	LO	1.18	43.7
it 12 5-14	66	24	10	SNLO	0.29	37.0
it 12 14-19	68	18	14	SNLO	0.36	37.1
it 13 0-6	28	56	16	SILO	1.40	38.4
UPLICATES:						
it 5 41-51	80	5	15	SNLO	0.04	33.6
it 9 0-7	40	43	17	LO	0.84	42.7

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nple ID	pH (units)	EC (mm/cm)	NO3-N (ppm)	P (ppm)	K (ppm)	SAR (units)
1 0-1	7.8	1.7	4.5	8.8	541.	4.7
: 1 1-25	8.2	2.8	0.5	1.8	266.	23.0
: 1 25-31	7.6	7.3	6.5	2.6	237.	27.1
. 2 0-6	7.6	0.7	0.6	5.7	200.	2.5
t 2 6-30	8.1	0.7	0.1	1.7	317.	2.8
2 30-46	8.4	0.8	0.1	1.4	65.	2.0
2 46-60	8.6	0.7	0.1	2.1	65.	1.4
3 0-5	7.7	0.7	1.0	6.4	232.	2.1
: 3 5-18	7.8	0.4	0.1	1.9	196.	0.9
t 3 18-32	8.4	0.8	0.1	1.2	139.	2.3
t 3 32-53	8.6	0.6	0.2	1.8	154.	0.8
: 4 0-12	8.7	0.6	0.2	1.3	142.	2.2
t 4 12-57	8.5	0.5	0.1	0.4	66.	1.8
: 4 57+	8.4	0.7	0.2	2.6	41.	1.2
t 5 0-5	8.2	0.8	1.7	6.8	487.	1.6
t 5 5-18	8.3	0.7	0.2	1.3	262.	1.4
: 5 18-41	8.3	0.7	0.4	3.7	89.	1.8
t 5 41-51	8.4	0.8	6.8	0.8	51.	1.8
t 6 0-7	7.6	0.6	4.8	10.3	437.	0.6
t 6 7-21	8.4	2.0	0.2	1.4	260.	17.6
t 7 0-9	8.1	0.7	7.1	3.8	454.	4.3
t 7 9+	8.4	0.7	0.4	4.8	164.	9.9
t 8 0-13	8.0	0.7	1.5	10.9	408.	1.7
t 8 13-30	8.2	0.7	0.2	2.0	85.	2.0
t 9 0-7	7.8	0.8	3.6	3.4	1120.	1.7
t 9 7-24	8.3	0.7	0.6	1.4	447.	2.7
t 9 24+	8.2	1.9	0.2	11.7	81.	6.5
t 12 0-5	8.3	0.7	10.7	6.1	975.	1.7
t 12 5-14	8.3	0.8	6.6	0.7	1327.	1.8
t 12 14-19	8.2	0.8	3.9	0.5	354.	2.8
t 13 0-6	7.7	0.8	9.8	4.5	481.	2.2
PLICATES:						
t 5 41-51	8.5	0.8	6.8	0.8	59.	2.
t 9 0-7	7.9	0.7	2.9	4.6	1020.	1.7

240 S. Main Street • Brighton, Colorado 80601 • (303) 659-2313
Mailing Address: P.O. Drawer 507, Brighton, CO 80601

COLORADO ANALYTICAL LABORATORY

SOIL WATER ENVIRONMENTAL

FERTILIZER AMMENDMENT RECOMMENDATIONS

November 2, 1989

REPORT TO: Randy Schroeder
Greystone Developement Consultants
5990 Greenwood Plaza Blvd., Suite 104
Englewood, CO 80110

Lab #8733

CROP: Dryland Native Grasses

Sample ID	Recommendations (lbs/acre) N	P2O5	K2O
Pit 1 0-1	40	0	0
Pit 1 1-25	40	30	0
Pit 1 25-31	20	30	0
Pit 2 0-6	40	30	0
Pit 2 6-30	40	30	0
Pit 2 30-46	40	30	0
Pit 2 46-60	40	30	0
Pit 3 0-5	40	0	0
Pit 3 5-18	40	30	0
Pit 3 18-32	40	30	0
Pit 3 32-53	40	30	0
Pit 4 0-12	40	30	0
Pit 4 12-57	40	30	0
Pit 4 57+	40	30	30
Pit 5 0-5	40	0	0
Pit 5 5-18	40	30	0
Pit 5 18-41	40	30	0
Pit 5 41-51	20	30	30
Pit 6 0-7	40	0	0
Pit 6 7-21	40	30	0
Pit 7 0-9	20	30	0
Pit 7 9+	20	30	0
Pit 8 0-13	20	0	0
Pit 8 13-30	40	30	0
Pit 9 0-7	40	30	0
Pit 9 7-24	40	30	0
Pit 9 24+	40	0	0
Pit 12 0-5	0	0	0
Pit 12 5-14	20	30	0
Pit 12 14-19	40	30	0
Pit 13 0-6	0	30	0

Reference: "Guide to Fertilizer Recommendations in Colorado"; Soltanpour; Colorado State University, Dept. of Agronomy; 1985

240 S. Main Street • Brighton, Colorado 80601 • (303) 659-2313
Mailing Address: P.O. Drawer 507, Brighton, CO 80601

APPENDIX G

LIST OF WILDLIFE

TABLE G.1

AMPHIBIANS AND REPTILES OBSERVED OR EXPECTED TO OCCUR IN THE CASTLE MOUNTAIN AREA

This list represents species expected to occur in the area based on range maps (Stebbins, 1986), habitat preferences, and literature records. Species actually recorded from the area by Gould (1987) and this study are indicated by "*". Questionable species are indicated by "?".

AMPHIBIANS

Bufo punctatus, Red-spotted Toad

REPTILES

TURTLES

Gopherus agassizi, Desert Tortoise

LIZARDS

Coleonyx variegatus, Banded Gecko

Sauromalus obesus, Chuckwalla

* *Dipsosaurus dorsalis*, Desert Iguana

* *Callisaurus draconoides*, Zebra-tailed Lizard

Crotaphytus insularis, Collared Lizard

* *Gambelia wislizeni*, Leopard Lizard

* *Sceloporus magister*, Desert Spiny Lizard

* *Uta stansburiana*, Side-blotched Lizard

Urosaurus graciosus, Long-tailed Brush Lizard

* *Phrynosoma platyrhinos*, Desert Horned Lizard

Xantusia vigilis, Desert Night Lizard

* *Cnemidophorus trigris*, Western Whiptail

Heloderma suspectum, Gila Monster

TABLE G.1
(Continued)

SNAKES

Leptotyphlops humilis, Western Blind Snake
Lichanura trivirgata, Rosy Boa
Phyllorhynchus decurtatus, Leaf-nosed Snake
Masticophis flagellum, Coachwhip
Masticophis taeniatus, Striped Whipsnake
Salvadora hexalepis, Western Patch-nosed Snake
Arizona elegans, Glossy Snake
Pituophis melanoleucus, Gopher Snake
Lampropeltis getulus, Common Kingsnake
Rhinocheilus lecontei, Long-nosed Snake
Sonora semiannulata, Western Ground Snake
Chinonactis occipitalis, Western Shovel-nosed Snake
? *Tantilla hobartsmithi*, Great Basin Black-headed Snake
Trimophodon lambda, Sonoran Lyre Snake
Hypsiglena torquata, Night Snake
Crotalus atrox, Western Diamondback Rattlesnake
Crotalus mitchelli, Speckled Rattlesnake
Crotalus cerastes, Sidewinder Rattlesnake
Crotalus scutulatus, Mohave Rattlesnake

TABLE G.2

BIRDS OBSERVED OR EXPECTED TO OCCUR IN THE CASTLE MOUNTAIN AREA

This list includes species expected in the area based on studies in the Clark Mountains (Environmental Monitoring and Service, 1985; Miller, 1940; Soda Springs Check List, 1988) and at the Soda Springs Field Station south of Baker. Those species actually observed in the area by Gould, 1987a,b and this study are indicated by "*."

Cathartes aura,Turkey Vulture
Accipiter striatus, Sharp-shinned Hawk
Accipiter cooperii, Cooper's Hawk
* *Buteo jamaicensis*, Red-tailed Hawk
Buteo swainsoni, Swainson's Hawk
* *Aquila chrysaetos*, Golden Eagle
* *Falco sparverius*, American Kestrel
* *Falco mexicanus*, Prairie Falcon
* *Callipepla gambelii*, Gambel's Quail
* *Alectoris chukar*, Chukar
* *Zenaida macroura*, Mourning Dove
Geococcyx californianus, Greater Roadrunner
* *Bubo virginianus*, Great Horned Owl
Athene cunicularia, Burrowing Owl
Asio otus, Long-eared Owl
* *Tyto allba*, Barn Owl
Chordeiles minor, Common Nighthawk
Chordeiles acutipennis, Lesser Nighthawk
* *Phalaenoptilus nuttallii*, Common Poorwill
Aeronautes saxatalis, White-throated Swift
Calypte costae, Costa's Hummingbird
Sphyrapicus varius, Yellow-breasted Sapsucker
* *Picoides scalaris*, Ladder-backed Woodpecker
Colaptes auratus, Common Flicker
Sayornis nigricans, Black Phoebe
* *Sayornis saya*, Say's Phoebe

TABLE G.2
(Continued)

* *Myiarchus cinerascens*, Ash-throated Flycatcher
* *Tyrannus vociferans*, Cassin's Kingbird
* *Tyrannus verticalis*, Western Kingbird
* *Eremophila alpestris*, Horned Lark
Hirundo phyrrhonota, Cliff Swallo
Gymnorhinus cyanocephalus, Pinyon Jay
* *Corvus corax*, Common Raven
Auriparus flaviceps, Verdin
* *Campylorhynchus brunneicapillus*, Cactus Wren
* *Salpinctes obsoletus*, Rock Wren
Thryomanes bewickii, Bewicks Wren
* *Mimus polyglottos*, Northern Mockingbird
* *Toxostoma bendirei*, Bendires Thrasher
Toxostoma dorsale, Crissal Thrasher
Toxostoma lecontei, LeConte's Thrasher
* *Turdus migratorius*, American Robin
Regulus calendula, Ruby-crowned Kinglet
* *Polioptila melanua*, Black-tailed Gnatcatcher
Polioptila caerulea, Blue-gray Gnatcatcher
* *Lanius ludovicianus*, Loggerhead Shrike
Vireo vicinior, Gray Vireo
Vireo solitarius, Solitary Vireo
Dendroica nigrescens, Black-throated Gray Warbler
Vermivora virginiae, Virginia's Warbler
Dendroica coronate, Yellow-rumped Warbler
Oporornis tolmiei, MacGillivray's Warbler
* *Wilsonia pusilla*, Wilson's Warbler
Myioborus pictus, Painted Redstart
Piranga ludoviciana, Western Tanager
Piranga flava, Hepatic Tanager
Pheuticus melanocephalus, Black-headed Brosbeak
Zonotrichia laucophrys, White-crowned Sparrow
Junco hyemalis, Dark-eyed Junco
Spizella passerina, Chipping Sparrow

TABLE G.2
(Continued)

Spizella breweri, Brewer's Sparrow
Spizella atrogularis, Black-chinned Sparrow
* *Amphispiza bilineata*, Black-throated Sparrow
Amphispiza belli, Sage Sparrow
Pooecetes gramineus, Vesper Sparrow
Chondestes grammacus, Lark Sparrow
Melospiza melodia, Song Sparrow
Pipilo erythrophthalmu, Rufous-sided Towhee
* *Pipilo chlozurus*, Green-tailed Towhee
* *Icterus parisorum*, Scott's Oriole
Sturnella neglecta, Western Meadowlark
Euphagus cyanocephalus, Brewer's Blackbird
Molothrus ater, Brown-headed Cowbird
Carduelis psaltria, Lesser Goldfinch
* *Carpodacus mexicanus*, House Finch
Carpodacus purpureus, Purple Finch
Sturnus vulgaris, European Starling

TABLE G.3

LIST OF MIGRATORY AQUATIC AND WATER BIRDS LIKELY TO BE ATTRACTED TO OPEN PONDS OF WATER IN THE EAST MOJAVE DESERT

List based on common water and shore birds observed at the Soda Springs Field Station of the California State Universities and Colleges south of Baker, California. None of these birds would be expected to stay at the site due to the lack of food. While all migratory birds are protected or regulated, none of these are specifically State or Federally listed as Rare or Endangered:

Belted Kingfisher

American Widgeon
Blue-winged Teal
Bufflehead
Canadian Goose
Canvasback
Cinamon Teal
Common Merganser
European Widgeon
Gadwall
Green-winged Teal
Hooded Merganser
Mallard
Pintail
Ruddy Duck
Shoveler
Lesser Scaup

Black-crowned Night Heron
Cattle Egret
Common Egret
Snowy Egret
Great Blue Heron
Green Heron
Little Blue Heron

Killdeer
Greater Yellowlegs
Lesser Yellowlegs
Long-billed Dowitcher
Least Sandpiper
Spotted Sandpiper
Willet
Semipalmated Sandpiper
Northern Phalarope
Wildon's Phalarope
American Avocet
Black-necked Stilt

Ring-billed Gull
Herring Gull

Double-crested Cormorant

American Coot

White-faced Ibis

Horned Grebe
Pied-billed Grebe
Western Grebe
Earred Grebe

TABLE G.4

MAMMALS OBSERVED OR EXPECTED TO OCCUR IN THE CASTLE MOUNTAIN AREA

This list is based on studies in the Clark Mountains (E.M.S., 1985), at the Soda Springs Field Station south of Baker, range maps (mostly from Ingles, 1965), habitats present, Gould, (1987 a,b) and this study. X = Known from area = (observed or reported), P = Possible in area (expected).

	HABITAT PREFERENCE			
	Creosote Bush	Joshua Tree	Black Bush	Pinyon Juniper
Macrotus californicus, California Leaf-nosed Bat	P	P		
Myotis thysanodes, Fringed Myotis		P	P	
Myotis californicus, California Myotis	P	P	P	P
Myotis subulatus, Small-footed Myotis		P	P	P
Myotis volans, Hairy-winged Myotis		P	P	P
Myotis yumanensis, Yuma Myotis		P	P	P
Lasiurus cinerius, Hoary Bat		P	P	P
Eptesicus fuscus, Big Brown Bat		P	P	P
Pipistrellus hesperus, Western Pipistrelle	P	P		
Antrozous pallidus, Pallid Bat	P	P		
Tadarida brasiliensis, Brazilian Free-tailed Bat	P	P		
Tadarida molossa, Big Free-tailed Bat		P		
Sorex merriami, Merriam Shrew	P	P	P	
Notiosorex crawfordi, Gray Shrew	P	P	P	
Lepus californicus, Black-tailed Hare	X	X	X	X
Sylvilagus audubonii, Desert Cottontail	X	X	X	X
Ammospermophilus leucurus, Antelope Ground Squirrel	X	X	X	X
Otosperophilus variegatus, Rock Squirrel		X?	X?	
Citellus Tereticaudus, Round-tailed Ground Squirrel	P			
Thomomys bottae, Botta Pocket Gopher	X	X	X	X
Perognathus longimembris, Little Pocket Mouse	P	P		
Perognathus formosus, Long-tailed Pocket Mouse	P			
Perognathus spinatus, Spiny Pocket Mouse	P	P	P	
Perognathus parvus, Great Basin Pocket Mouse		P	P	P

TABLE G.4
(Continued)

	HABITAT PREFERENCE			
	Creosote Bush	Joshua Tree	Black Bush	Pinyon Juniper
Dipodomys merriami, Merriam Kangaroo Rat			X	
Dipodomy deserti, Desert Kangaroo Rat	P	P		
Reithrodontomys megalotis, Western Harvest Mouse	P	P	P	P
Peromyscus crinitis, Canyon Mouse		P	P	P
Peromyscus eremicus, Cactus Mouse	P			
Peromyscus boylii, Brush Mouse		P	P	P
Peromyscus truei, Pinyon Mouse				P
Peromyscus maniculatus, Deer Mouse	P	P	P	P
Onychomys torridus, Southern Grasshopper Mouse	P	P		
Neotoma lepida, Desert Wood Rat	X	X	X	X
Mus musculus, House Mouse			P	P
Vulpes macrotis, Kit Fox	X	X	P	
Urocyon cinereoargenteus, Gray Fox		P	P	P
Canis latrans, Coyote	X	X	X	X
Bassariscus astutus, Ringtail		P	P	P
Taxidea taxus, Badger	P	P	P	P
Spilogale putorius, Spotted Skunk	P	P	P	P
Mephitis mephitis, Striped Skunk	P	P	P	P
Lynx rufus, Bobcat	P	P	P	P
Felis concolor, Mountain Lion		P	P	P
Equus asinus, Burro	X	X	X	X
Odocoileus hemionus, Mule Deer		P	P	P
Ovis canadensis, Bighorn		X	X	X
Bos taurus, Cattle	X	X	X	X

TABLE G.5

SPECIAL INTEREST WILDLIFE SPECIES EXPECTED TO OCCUR IN THE VICINITY OF THE CASTLE MOUNTAIN PROJECT SITE

The following species are afforded some protection by State or Federal listing or classification, or are listed as sensitive by the California Natural Diversity Data Base.

	SPECIES	STATUS			
		FWS	BLM	DFG	CNDDB
	REPTILES				
*	*Gopherus agassizi*, Desert Tortoise	C2	S	P	--
	Heloderma suspectum, Gila Monster	C2	S	--	--
	BIRDS				
*	*Aquila chrysaetos*, Golden Eagle	--	--	P	X
	Buteo regalis, Ferruginous Hawk	C2	--	--	--
	Buteo swainsoni, Swainson's Hawk	C2	--	--	X
*	*Falco mexicanus*, Prairie Falcon	--	--	--	X
*	*Toxostoma bendirei*, Bendire's Thrasher	--	--	--	X
	Vireo vicinior, Gray Vireo	--	--	--	X
	MAMMALS				
*	*Ovis canadensis*, Bighorn Sheep	--	S	R	--
	Macrotus californicus, California Leaf-nosed Bat	C2	--	--	--
	Plecotus townsendii, Townsend's Big-eared Bat	C2	--	--	--

FWS - U.S. Fish and Wildlife Service
- T - Threatened
- E - Endangered
- C1 - Candidate, Category 1
- C2 - Candidate, Category 2

DFG - California Department of Fish and Game
- P - Protected
- R - Rare

CNDDB - California Natural Diversity Database
- X -

BLM - U.S. Bureau of Land Management
- S - Sensitive Species

* Observed on or in vicinity of proposed project site.

TABLE G.6

BATS EXPECTED TO OCCUR IN THE VICINITY OF THE CASTLE MOUNTAIN PROJECT SITE

FAMILY/SPECIES	COMMON NAME
Phyllostomidae	
Macrotus californicus	California Leaf-nosed Bat**
Vespertilionidae	
Myotis yumanensis	Yuma Myotis
Myotis thysanodes	Fringed Myotis
Myotis volans	Long-legged Myotis
Myotis californicus	California Myotis
Lasionycteris noctivagans	Silver-haired Bat
Pipistrellus hesperus	Western Pipistrelle
Eptesicus fuscus	Big Brown Bat
Lasiurus cinereus	Hoary Bat
Plecotus townsendii	Townsend's Big-eared Bat**
Antrozous pallidus	Pallid Bat
Molossidae	
Tadarida brasiliensis	Brazilian Free-tailed Bat

Species of Special Concern (Williams, 1986):

* Highest Priority
** Second Priority

Nomenclature follows Jones et al. (1982)

APPENDIX H

CULTURAL RESOURCE CONSULTATION

RECEIVED
APR 27 1990

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Stateline Resource Area
P.O. Box 26569
Las Vegas, Nevada 89126

In reply refer to:
8100
(NV-054)

APR 21 1990

Memorandum

To: Area Manager, Needles Resource Area (CA-069)
Attention: Elena Daly, Resource Branch Chief

From: Area Manager, Stateline Resource Area (NV-054)

Subject: Completion of Section 106 for Viceroy Gold Castle Mining Project

This is in reference to the Viceroy Gold Castle Mountain Mining project. Section 106 consultation was completed in July 1989 for the project by California and Nevada BLM and SHPO, and the Advisory Council on Historic Preservation. The proponent subsequently changed the access road location in Nevada, prompting an additional cultural resource inventory and consultations with Nevada and California SHPOs. A letter advising the Advisory Council on Historic Preservation that the only eligible site in Nevada for the project was now out of the area of potential effect was sent from this office on Mar. 2, 1990 (see Attachment 1). That office was requested to provide comments within 15 days of receipt. The undated return receipt request was mailed from that office on March 8, 1990 and received in this office on March 12 (Attachment 2).

No comments have been received from the Advisory Council on Historic Preservation. This constitutes the completion of Section 106 consultation on the revised portion of the project under 36 CFR 800.5. No significant sites in Nevada will be affected by this project. This information can be placed into the EIS. If you have any further questions please contact Keith Myhrer at (702) 646-8879.

cc: George Mackfessel (CA-069.23)

Attachment 1

8100
(NV-054)

MAR 2 1990

CERTIFIED MAIL NO. 13995
RETURN RECEIPT REQUESTED

Alan Stanfill
Chief, Western Office of Project Review
Advisory Council on Historic Preservation
730 Simms Street, Room 450
Golden, Colorado 80401

Dear Mr. Stanfill:

This letter is in reference to the Viceroy Gold Castle Mountain Mining project. A package for the finding of no adverse effect through data recovery for the project was reviewed by your office in July, 1989, with no objections (Letter dated July 14, 1989 to Sacramento, California BLM). The project area includes access through southwest Nevada. The original proposed access road from Searchlight, Nevada to Hart Mine in California used the Barnwell/Searchlight railroad grade, a site determined not eligible for nomination to the National Register of Historic Places. Due to conflicts over protection of the endangered desert tortoise, an alternate access route has been chosen by the proponent. This selected route intersects the Nipton road and runs south to the Barnwell/Searchlight route about one mile east of the California border. Enclosed Map 1 shows the route. Las Vegas District BLM Cultural Resource Report 5-1949(N) describes a Class III level inventory of the new access, with no cultural resources found.

A result of utilization of the selected alternate is the avoidance of Juan Obsidian Source site 26CK3849/BLM 53-4971, determined eligible for nomination. The site is one mile east of the selected alternate and is no longer considered within the area of potential effect. As stated above, a treatment plan for the mitigation of adverse effects to this site and other eligible sites was reviewed by your office in July, 1989. Because Juan Obsidian Source site is no longer within the area of effect, no further work at the site is required for this project.

This letter is to notify you of the determination by Las Vegas District BLM and Nevada SHPO that utilization of the selected alternate will not affect properties of National Register quality in Nevada. Nevada State Historic Proservation Office has reviewed Cultural Resource Report 5-1949(N) and agreed with the determination of no effect in Nevada. A notification was also sent to California SHPO, and a reply from Rob Jackson received by phone on Feb. 25, 1990. California SHPO agrees with this determination. This does not change the no adverse effects determination for the project as a whole.

I request any comments on this no effects determination in Nevada through avoidance of site 26CK3849, without changing the no adverse effects determination for the project as a whole, be submitted to this office within 15 days of receipt of this letter. If you have any questions please call Keith Myhrer, Area Archaeologist, at (702) 646-8879.

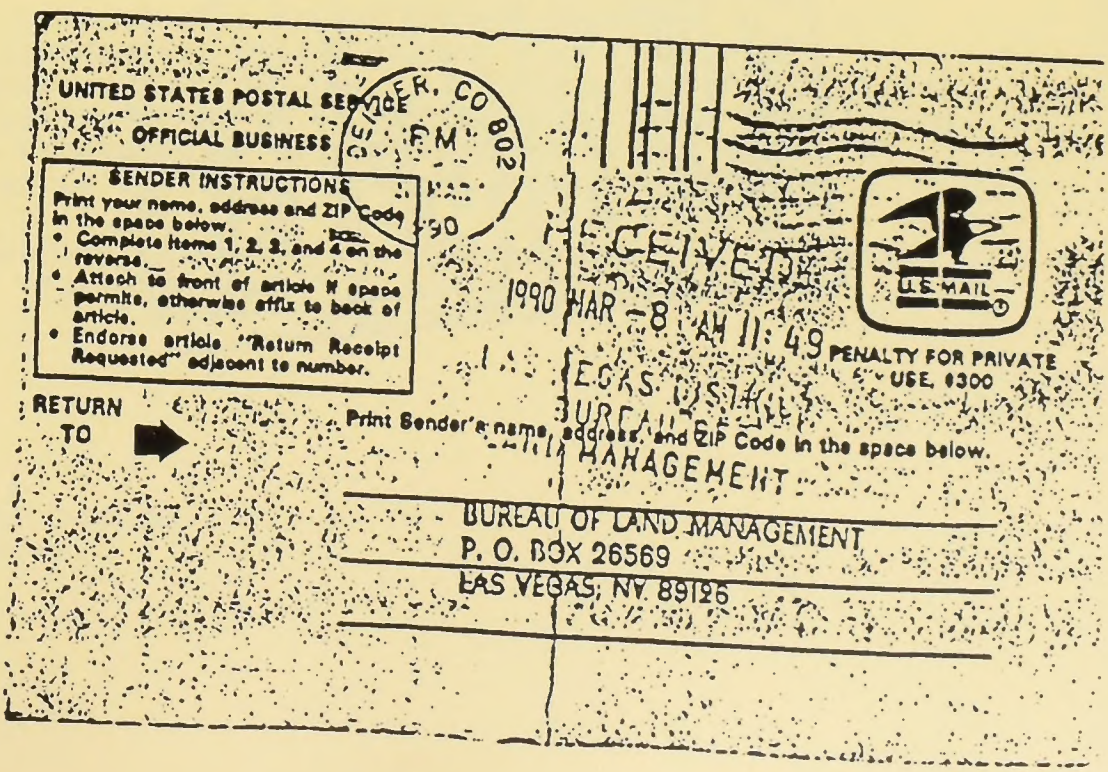
Sincerely,

BEN E COLLINS

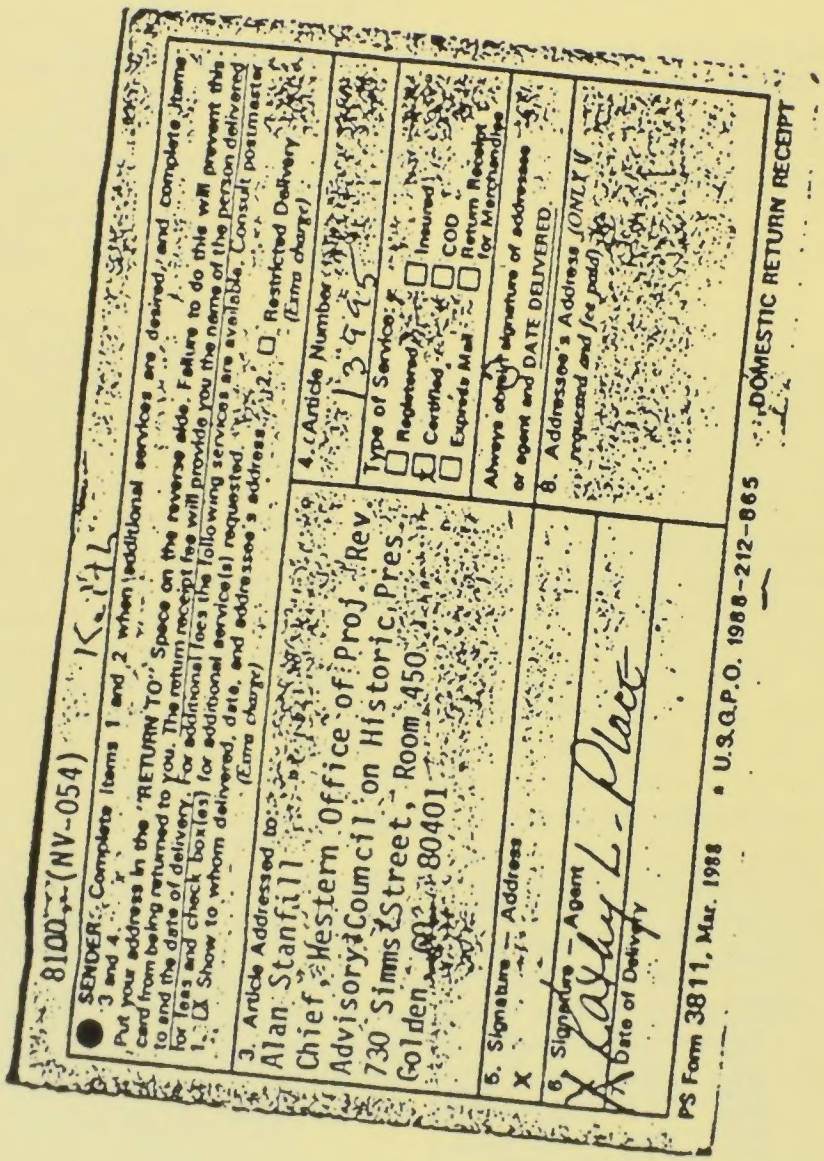
Ben Collins
District Manager

2 Enclosures
1. Map of the selected alternate access
2. Agreement letter (copy) from Nevada SHPO

KMyhrer/gm 2/28/90
Wang No. 1858a



Attachment 2



8100 (NV-054) Kelly

SENDER: Complete items 1 and 2 when additional services are desired, and complete items 3 and 4.
Put your address in the "RETURN TO" Space on the reverse side. Failure to do this will prevent this card from being returned to you. The return receipt fee will provide you the name of the person delivered to and the date of delivery. For additional fees the following services are available. Consult postmaster for fees and check box(es) for additional service(s) requested.
1. ☒ Show to whom delivered, date, and address of delivery. (Extra charge)
2. ☐ Restricted Delivery (Extra charge)

3. Article Addressed to:
Alan Stanfill
Chief, Western Office of Proj. Rev
Advisory Council on Historic Pres.
730 Simms Street, Room 450
Golden, CO 80401

4. Article Number
P 134 745

Type of Service:
☐ Registered ☐ Insured
☒ Certified ☐ COD
☐ Express Mail ☐ Return Receipt for Merchandise

Always obtain signature of addressee or agent and DATE DELIVERED.

5. Signature — Address
X

6. Signature — Agent
X Kelly L. Place

7. Date of Delivery

8. Addressee's Address (ONLY if requested and fee paid)

PS Form 3811, Mar. 1988 * U.S.G.P.O. 1988-212-865 DOMESTIC RETURN RECEIPT

file CM 5B1b

Advisory
Council On
Historic
Preservation

The Old Post Office Building
1100 Pennsylvania Avenue, NW, #809
Washington, DC 20004

Reply to: 730 Simms Street, Room [redacted] 401
Golden, Colorado 80401

July 14, 1989

Mr. Richard F. Johnson
Deputy State Director
Lands and Renewable Resources
Bureau of Land Management
2800 Cottage Way
Sacramento, CA 95825

REF: Castle Mountain Mining Project, Viceroy Gold Corporation, California and Nevada.

Dear Mr. Johnson:

On June 26 and 29, 1989, we received from your office and the Stateline Resource Area, Nevada, respectively, findings that the referenced undertaking would have no adverse effects on historic properties identified within the administrative areas of each office. Segmenting the effects of an undertaking on the basis of State or administrative boundaries is inappropriate under the regulations, 36 CFR Part 800. However, because the two BLM offices have reached the same finding of effect and will treat the effect of the project on historic properties in the same manner under the same treatment plan, we do not object to your finding that the undertaking will have no adverse effect.

For future undertakings that extend across State or administrative boundaries, please ensure that the BLM's compliance efforts are coordinated to enable the Agency Official to seek the Council's comments on the effects of the undertaking as a whole, and irrespective of the location of the agency's administrative units within the area of potential effects.

If you have questions, please contact Alan Stanfill at (303) 236-2682 or FTS 776-2682.

Sincerely,

for Claudia Nissley
Director, Western Office
of Project Review

MAR 17 '89 13:23 OCRIVENER

OF CALIFORNIA – THE RESOURCES AGENCY

GEORGE DEUKMEJIAN, Governor

CE OF HISTORIC PRESERVATION
ITMENT OF PARKS AND RECREATION
FFICE BOX 942896
MENTO, CALIFORNIA 94296-0001
45-8006

ROUTING TO:	DATE	INIT
DM		
ADM		
SA		
PIPE		
P&EC		
PA		
Admin		
OPS		
RES		
I...		
AMs		
ACTION BY: RETURN TO:		

9/11 CM 5B16

REPLY TO:BLM880509A

March 2, 1989

Mr. Gerald Hillier
District Manager
Bureau of Land Management
California Desert District
1695 Spruce Street
Riverside, California 92507

Re: Castle Mountain Venture Mining Plan of Operation.

Dear Mr. Hillier:

The Office of Historic Preservation (OHP) has reviewed and would like to comment on your submission of the cultural resources documentation for the above-referenced project.

We reviewed Dr. Wilke's report and treatment plan with great interest. The document is extremely responsive to OHP comments on the draft document. The report is more than adequate to ensure that potential historic properties within the Area of Potential Effects (APE) have been identified.

The OHP agrees that the following sites will not be affected by the proposed project, as they occur outside of the APE: CA-SBr-1395, -2722, -5837-H, -5856, -5857, -5859, -5874, -5875, -5877-H, -5878, -5879, -5918, -5940, -5860, -5861, -5862, -5870, -5941, -5942, -5957, -5961, -5971, -6054, -6107, and -3060-H (Hart Town Site).

The OHP has previously agreed with the BLM that the following prehistoric archaeological sites are National Register of Historic Places (NRHP) ineligible: CA-SBr-5700, -5701, -5702, -5703, -5704, -5709, -5869, 5870, -5871, 5873, -5876, -6055, and -6105.

We also agree that the following historic archaeological sites fail to meet the criteria for inclusion in the NRHP, lacking integrity and important research potential: CA-SBr-3040-H (Hart well and tank site); -5710-H (Valley View Mine and Mill site);and CA-SBr-3047-H (California segments of the former Barnwell and Searchlight railroad grade).

Also included in your recent submission was a report titled "CA-SBR-5872: A Prehistoric Lithic Raw Material Prospect In The Castle Mountains, San Bernardino County, California." The California Archaeological Resource Identification and Data Acquisition Program: Sparse Lithic Scatters (CARIDAP:SLS) was applied to CA-SBR-5872 and the site was found to qualify. The report authors supplemented the data recording program with attribute analyses they felt were salient. Such a supplement to accommodate regional circumstances is precisely the intent of the

program. We agree that CA-SBR-5872 is ineligible for the NRHP, based on application of the CARIDAP:SLS and qualification of the site as a SLS.

We were extremely pleased to see the critical analysis of the program. The feedback and critique provided in the report is exactly the kind we have attempted to solicit from California archaeologists for over two years with little response. Dr. Wilke's consideration of the program is the most thorough and thoughtful to date. Several of the concerns noted in the critique, particularly those of a research nature, have been noted in other applications of the program, and will be taken into serious consideration in its revision.

Due to project redesign and protective measures, occurrence outside the project area, or determination of NRHP ineligibility, the archaeological sites referenced above need not be considered further for this Section 106 undertaking.

This leaves several archaeological sites within the APE that will be subject to potential impacts. Accordingly, the OHP has reviewed the information provided by the consultant and agrees that archaeological sites CA-SBr-5705, -5706, -5707, -5708, and -6055 are NRHP eligible under 36 CFR 60.4(d).

Also enclosed was a treatment plan for the above-referenced properties. This plan proposes treatment for one site in Nevada (26-CK-3849) which we will leave to the Nevada SHPO for review.

We generally agree with the measures proposed to recover data from prehistoric quarry sites CA-SBr-5705, -5706, -5707, and -5708. However, the author raises the possibility that five excavation units per site will be insufficient to meet data requirements, and places no upper limit to the number that would be excavated. While there is a low probability that more than five units per site will be necessary, we propose that the BLM consult with the OHP prior to the excavation of additional units. In turn, this may require involvement of the Advisory Council on Historic Preservation, or their willingness to accept BLM-OHP consultation as satisfactory in modifying the amount of excavation.

The NRHP eligibility determination for CA-SBR-6055 was made on the basis of surface observations and comparison with data from similar regional sites. As the author notes, performing test excavation in such a visible location would have endangered the site by exposing it public attention. The lack of subsurface data makes the development of a specific data recovery plan exceedingly difficult, as the author also mentions. However, 12, one meter-square excavation units and clearing of the shallow deposit within the shelter seem reasonable. Therefore, we agree with the proposed scope of work.

Based on the proposed treatment plan, with the condition for consultation should the need for additional excavation be

determined, the OHP agrees that the proposed project will not adversely effect historic properties. We understand that five regional tribal governments have been afforded the opportunity to comment on the proposed undertaking but no concerns were revealed. We also understand that the potential for human remains at any of the five NRHP eligible archaeological sites is low.

Please submit documentation, along with a copy of this letter, to the Advisory Council on Historic Preservation for their review and comment.

Thank you for considering cultural resources during project planning. If you have any questions please contact Mr. Robert Jackson of my staff, at (916) 322-9602.

Sincerely,

Kathryn Gualtieri
State Historic Preservation Officer

APPENDIX I

REFERENCES AND RESOURCES

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APPENDIX I

REFERENCES AND RESOURCES

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